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AMERICAN MACHINIST

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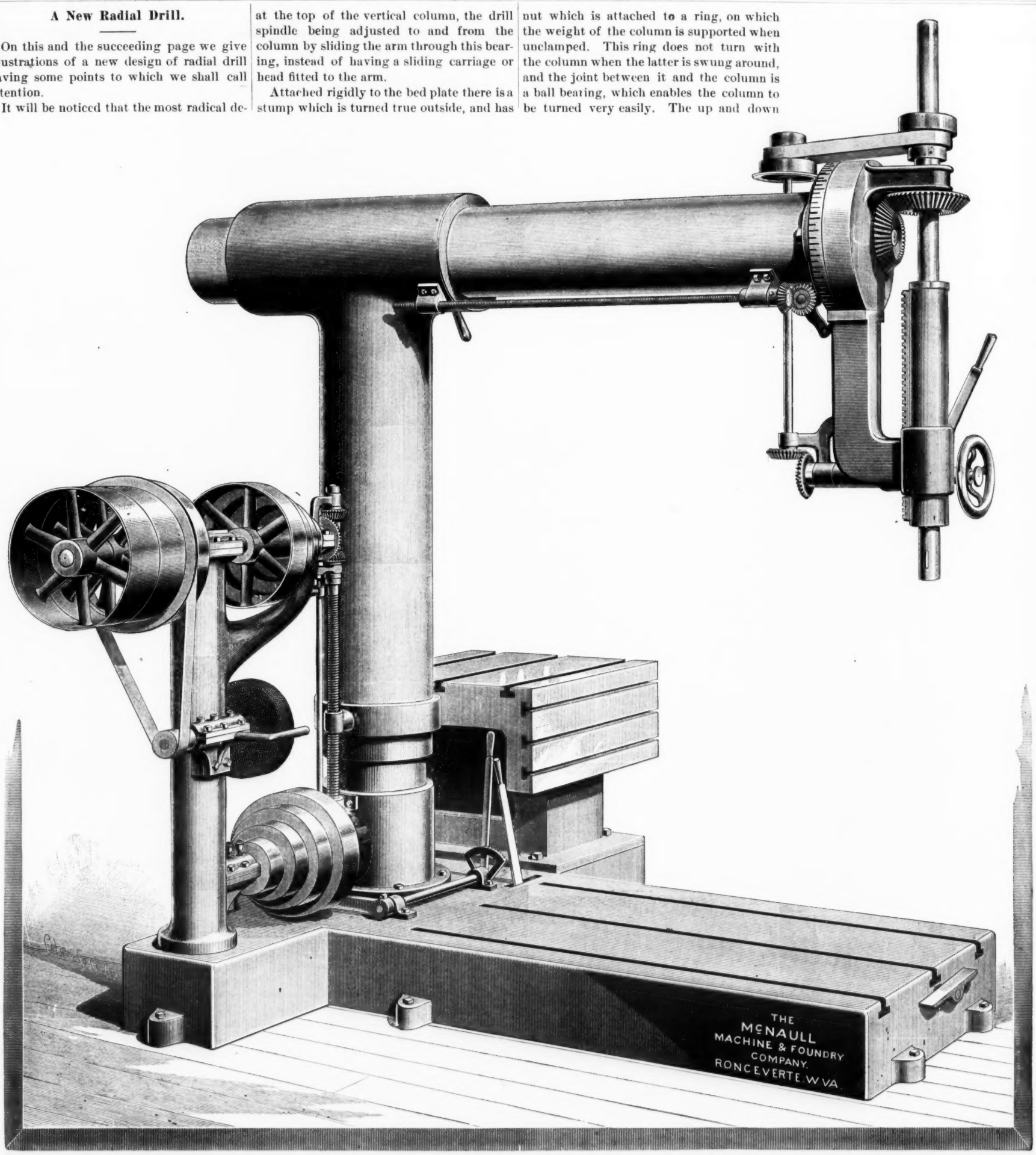
A New Radial Drill.

On this and the succeeding page we give illustrations of a new design of radial drill having some points to which we shall call attention.

It will be noticed that the most radical departure from the regular practice in building such machines is in the construction and arrangement of the arm, which is cylindrical, and made to slide through a sleeve bearing at the top of the vertical column, the drill spindle being adjusted to and from the column by sliding the arm through this bearing, instead of having a sliding carriage or head fitted to the arm.

Attached rigidly to the bed plate there is a stump which is turned true outside, and has fitted to it the vertical column. This column can be raised and lowered on the stump by means of the vertical screw seen at the side, which is driven by power, and engages in a nut which is attached to a ring, on which the weight of the column is supported when unclamped. This ring does not turn with the column when the latter is swung around, and the joint between it and the column is a ball bearing, which enables the column to be turned very easily. The up and down movement of the column is controlled by means of the double-ended clutch, bevel gears, and reversing lever shown.



The arm is moved out and in through the bearing in the column by means of the screw seen, which is driven by means of a crank near the head and bevel gears. The bearing is split at each end, so that when the

arm is adjusted it can be firmly clamped in position.

Power is transmitted to the spindle by means of a vertical shaft which passes up through the column, and by means of bevel gears drives a shaft which passes through the center of the arm to the bevel gears seen in front.

The head which carries the spindle can be rotated completely around, and drilling can be done in any direction from vertically downward to vertically upward, at either side. The feed shaft is attached to this head and the feed works equally well in any position.

At the left of the main column is a smaller one, on which is placed the countershaft, and from this countershaft is driven an emery wheel, on which drills can be ground. The belt for driving the machine is shifted by means of the lever seen coming up through a slot in the bed plate, or by means of the trip lever in front, which can be worked by the foot.

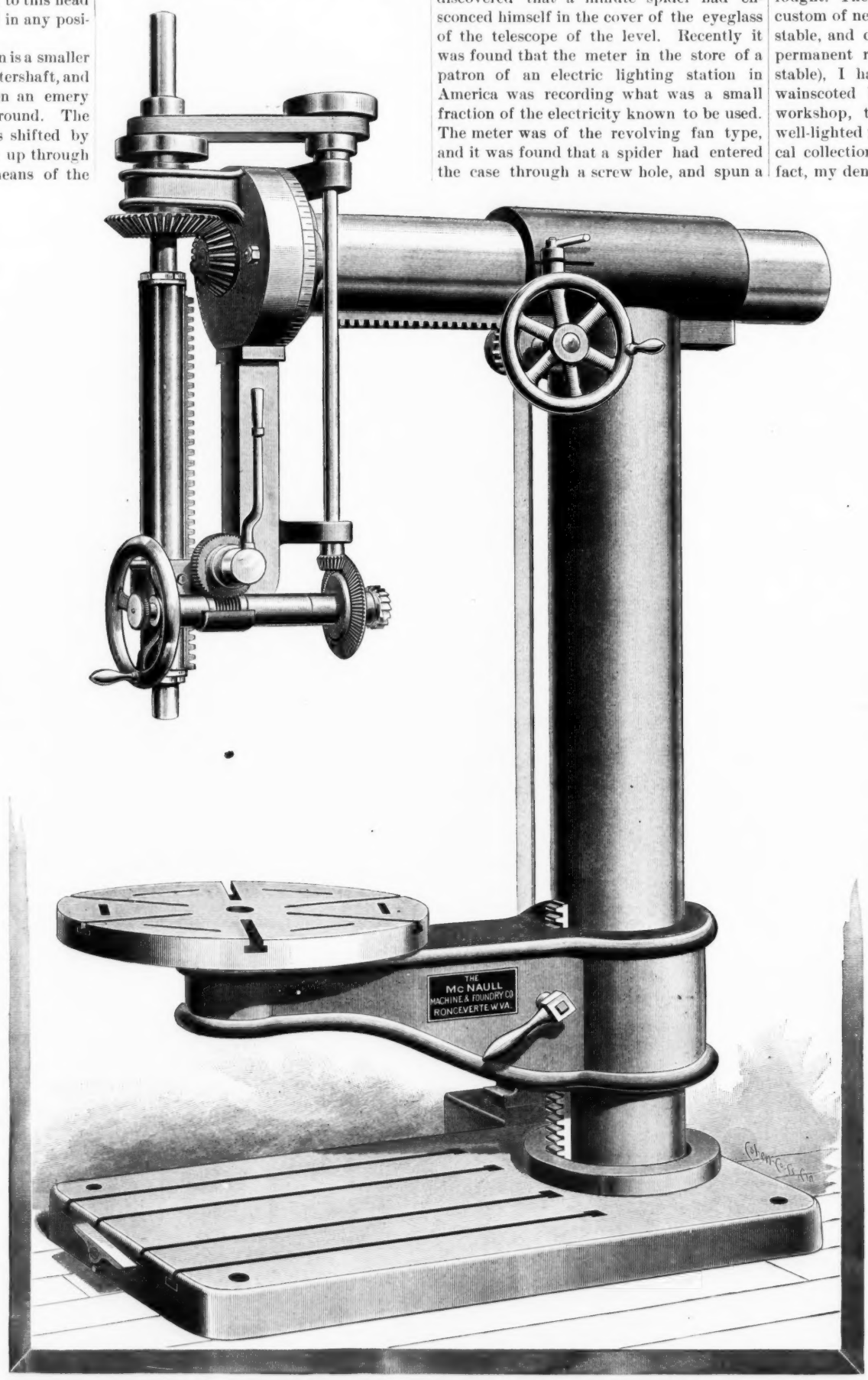
The column is 13 inches diameter, and its height when up, 8 feet. The machine drills to the center of a circle 10 feet in diameter, and the greatest distance from the bed plate to the end of the spindle is 6 feet 5 inches. Total height of the machine, 9 feet 2 inches. The spindle is 2½ inches diameter, has 20 inches traverse in the head, and has a No. 4 Morse taper hole. The floor space occupied is 4½ x 6½ feet, and the machine weighs about 5,000 pounds.

The machine on this page is smaller, and has some differences of construction, which will be apparent on inspection of the cut.

The column in this machine does not move vertically as in the other, neither does it turn, the equivalent of these functions being performed by the table fitted to the column.

In this machine the arm is moved back and forth by means of a rack and pinion, instead of a screw. The diameter of the column is 10 inches, and its height 6 feet 10 inches. The machine drills to the center of a circle 60 inches diameter, and the greatest distance from the end of the spindle to the bed plate is 4 feet. Spindle is 2½ inches diameter, has 20 inches traverse, and is fitted for a No. 4 Morse taper shank. The floor space required is 30x52 inches, and the weight about 2,500 pounds.

These machines, with other sizes as well as other modifications of the design to suit different purposes, are built by the McNaull Machine and Foundry Company, Ronceverte, W. Va.



A NEW RADIAL DRILL.—SEE PAGE 1.

Spiders and Engineers.

Ever since the story of Robert Bruce and the spider, that insect has been proverbially held up to view as an example of pertinacious skill. An attempt to establish instinct as a guide to reason is, however, a fallacy. The setting hen is an example of instinct, not maternal constancy. This perseverance of spiders may have been an encouragement to Robert Bruce, but it is often a discouragement in engineering work. In sinking plumb lines down shafts for middle headings in tunneling, in order to obtain an alignment for the tunnel, the accuracy of the work is often seriously impaired by spiders attaching their webs to the lines and drawing them towards the walls with sufficient tension to introduce material errors in the position of the plumb bobs. In fixing the alignment of Hoosac tunnel, Massachusetts, U. S., at the bottom of a shaft 1,028 feet deep, the spiders prevented accurate work with plumb lines, until two cases were made enclosing the whole length of these lines. For shallow pits the spiders' webs can be broken by raising the lines, and then lowering them to position shortly before fixing upon points; but in this instance the distance was so great as to require several hours before the vibration of the lines would cease, even with the bobs in vessels of mercury. The suggestion is made that the lines might be freed from similar interferences by insulating the suspended apparatus and the bob from the earth, and attaching a grounded electric light circuit to the wire, relying upon the dampness in the pit to give sufficient conductivity to the cobwebs to cause them to be scared by the escape when any cobweb connected the earth to the plumb wire. Many years ago, when the writer used the level in an engineering party, there were frequent difficulties with the instrument. Curved lines like arcs of circles would appear in rapid sequence across the field of vision, which would be nearly eclipsed at times. These difficulties would arise at irregular and generally inconvenient intervals. The instrument was carefully examined without revealing any cause. The writer, distrustful of his own eyesight, visited an eminent oculist, receiving some vague advice and paying a realistic fee. It was afterwards discovered that a minute spider had ensconced himself in the cover of the eyeglass of the telescope of the level. Recently it was found that the meter in the store of a patron of an electric lighting station in America was recording what was a small fraction of the electricity known to be used. The meter was of the revolving fan type, and it was found that a spider had entered the case through a screw hole, and spun a web in such a manner as to prevent the free revolution of the fans. If gas meters were susceptible to similar treatment, it is feared there might be a tendency to perforate the cases and imprison spiders therein.—*Engineering* (London).

The amount of British coal imported into Italy in 1890 was as much as 1,493,600 tons, against 1,307,600 tons in 1889 and 1,279,400 tons in 1888. Of the above total import in 1890, 749,000 tons were from Cardiff, 574,700 tons were from Newcastle, and the rest was Scotch and North English coal from Liverpool and Hartlepool.—*The Black Diamond.*

Early Engineering Reminiscences.

BY GEO. ESCOL SELLERS.

PERPETUAL MOTION—(FIRST PAPER.)

It is about three years since I removed from Southern Illinois to this historic ground, adjoining Bragg's headquarters, where the battle of Missionary Ridge was fought. Then, instead of following the usual custom of new settlers, of building a barn or stable, and camping in it while building a permanent residence (having no use for a stable), I had erected a two-story frame wainscoted building, the lower story as a workshop, the second story being a large, well-lighted room for my library, archæological collection, drawings, paintings, etc.—in fact, my den; for in it I have my writing table, cases, cabinets, and around me what has been preserved of interest to me from the accumulation of a long lifetime. For the largest portion of the first year we—that is, myself, daughter and grandson—occupied these rooms. When our house was finished, and we removed into it, I commenced the arrangement of my collection, many boxes of which are not yet unpacked; devoting all the time I could to assorting, arranging for preservation or destroying an accumulation of papers and letters, many of them going back over two-thirds of a century, and it was not until about the 1st of last September that I found leisure to begin to look over my work, with a view of cutting out such reminiscences as might be of interest to the readers of the AMERICAN MACHINIST. I found most of the papers that had been preserved so mixed up with personal matters, that, without much razeeing, they could not be shaped so that I would be willing to make them public. They shall be so preserved that, after I am gone, they may be useful to those interested in the early civil and mechanical engineering, if my representative should think them worth the trouble of overhauling. The old papers led me into such recollections and train of thought that I jotted in pencil the notes for the following paper; and on the 26th of last September I looked over these notes, and resolved that on the next day I would shape and transcribe them; but it was a case where "man proposes, but God disposes." Being the time to close my den for the night, to go down from it I have four steps to a platform, from which the stairs turn at a right angle, and so on to the lower floor. I had taken the first two steps down, when I turned to see that my pet cat was following; the sudden turn induced a spell of vertigo that I have been occasionally subject to; I lost my balance and fell only the two steps onto the platform, but in such a position as to rupture some of the knee ligaments. This laid me on my back, and while in the hands of the surgeon, to complicate matters I had a severe attack of pneumonia, and it was four months before I could sit up, and six before I could leave my room on crutches, which I have now thrown aside, and manage to hobble about by aid of a cane, and the occasional assistance of an attendant. Recu-

peration, if at all, to a man in his 83d year must necessarily be slow, and, at best, imperfect.

I doubt if there be many living practical mechanical engineers who have not been time and again appealed to, bothered, and had their time wasted by some ignorant, uneducated genius with a new motor or "perpetual motion" device, and in almost every case asking aid to make some trifling alteration, addition or adjustment to make it an entire success. In my long experience I have met with many grades of these cranks. The charlatan soon exposes himself, and may be summarily dismissed. But the man who, for want of knowledge of immutable laws, theorizes and bases his theories on false premises, probably starting on the admission in his mind of a slight error as a truth, goes on multiplying errors under a conviction that he is right, and all who have preceded him have been wrong—this man is to be pitied, and time is not wasted in setting him right. I have had cases where, by simply directing to a course of study of the simplest first principles, has had the desired effect, and the genius who had wasted brain and time would himself discover his error, and rather sheepishly acknowledge it; but when the man has gone so far in convincing himself of his own superior knowledge and infallibility, and believes himself to be divinely commissioned as a medium through whom the entire human race is to be benefited, the case is very different, for if successful in proving to this man his error, the mental effect may be disastrous.

I have been led to this train of thought by finding among the old papers, notes and sketches of apparatus that I constructed to ocularly demonstrate to Mr. Horatio Gates Spafford, of Lansingburgh, N. Y., that the starting point on which he based the entire theory of his motor was false. Mr. Spafford was a true, sincere, conscientious man; he was a seeker after truth, and yet he had deceived himself. He repudiated the idea of his motor being a perpetual motion; yet his theory, if carried to its natural sequence, ended not only in perpetual motion, but a multiplier of power—I might say creator of power without limit. His case was a sad one, and I always look back with regret on the part I was obliged to take to open his eyes and dispel an illusion that had been so long cherished and dwelt upon that his life almost depended on it. Thinking this over recalled other incidents in the same connection, one of which in my boyhood was strongly impressed on my mind, and as I do not know any one now living who can describe it from their own knowledge, I shall try to do so, believing it will be of interest to the readers of the AMERICAN MACHINIST. Before describing Spafford's motor, as it so long preceded it; I refer to Readhefer's perpetual motion, which in its time created as great a furor in the world as any movement motor has. With our knowledge of the present time we look with amazement at the credulity of men of means, supposed to possess more than ordinary intelligence, investing their money in secret for interests in theoretical motors claimed by their projectors to be regenerators of the economic laws of the world. This was exactly what was claimed by Readhefer, and interests in his wonderful discovery were eagerly purchased.

I have no way of fixing the date of this excitement, nearer than that my first recollection of it was hearing the matter discussed during one of my summer vacations at the residence of my grandfather, Charles Wilson Peale, who at that time was living at his country-seat near Germantown, one of Philadelphia's suburbs; this would place the date somewhere near the end of the teens of the present century. I recollect that at one of these discussions my grandfather expressed himself as believing that Readhefer, though at that time he was practicing a fraud in exhibiting his motor in operation on the original conception of the theory on which he based its operation, had been honest in the belief that the machine would be a perpetual self-mover; and that it was not until he had discovered his error, after having wasted his time and impoverished himself, that he resorted to the ingenious device that enabled him to exhibit his machine in operation, to recuperate by the exhibition fees and gull the creditors into purchase of interest in his perpetual motor. My father, who was present at this discussion, was not disposed to be so lenient; he freely expressed himself as believing the thing to have been a fraud or trick from its earliest conception.

The machine then on exhibition being within easy walking distance, it was proposed that the party go to see the wonderful machine in motion; I, as a boy, accompanied them. We found quite a crowd there; lines of carriages in waiting; many pedestrians from the city. The machine was running, and many of the visitors were holding their pocket-knives on the grindstone that was apparently being driven by the perpetual motor. Mr. Readhefer was explaining in his characteristic manner the principle on which the machine was built and operated. "You see," said he, "the machine running, and the power with which it turns the grindstone; now this power is entirely due to the manner the little carriages are loaded on the revolving platform"; he then said he would answer any questions, and fully illustrate the principle. "You see here I have a little four-wheel carriage; its platform is double, and so arranged that I can set it at any angle. I have this plain plank for it to run on; now the platform is level and parallel with the plank. I place on it this weight" (which was a leaden brick, rectangular, about 3"x4", and about one inch thick); the carriage stood still, gravity being directly down, the weight equally distributed on all the wheels; the bed was then raised and fixed at an angle of about 45°, and the weight carefully placed on it; the carriage started and ran some 10 feet or 12 feet, then stopped. A very plain-looking man standing by said: "Friend Readhefer, I think thee gave it a little starting push." "Not the least," was the reply. "Watch me, I will show it again." This time with one hand he held the carriage in check, while with the other he placed the weight on the incline; when he loosed his hold on the weight, simultaneously removing the hand that held the carriage in check; it was evident to all close watchers that the weight slid down the incline a short distance to its stop. "I see," said the plain inquisitive man, "that thee did not give it a push, but thee let the weight slide enough to start the carriage; but, see, it did not run as far as the first time. Now, Friend Readhefer, when I load my wheelbarrow with rock it takes all my strength to start it, but when started I can trundle it along with ease. This starting the scholars call overcoming the inertia; but I am no scholar, I only know what I see or feel; but it does seem to me that if thy weight loaded on the slant exerts a power sufficient to start the carriage to overcome the inertia, and that power is, as thee asserts, constant, the carriage, instead of stopping, should increase in speed, and go on running forever." "And it would," said Readhefer, "if it were not for the friction and the resistance of the air; these, you see by my machine running, I have overcome," pointing to the machine, which most certainly was running, and apparently exerting some force. The plain inquisitive fellow seemed to have ruffled Readhefer so much that most of his attention was given to him, either to convince or to get rid of him. He said to him: "I think I have here what will convince you that a fixed weight in the position I place them on my carriages will exert a constant pressure in that direction that will and does force the carriage ahead, and if friction and all other obstructions are eliminated its onward course would be perpetual, as you see it does in my working machine. Here I have this cast-iron cannon suspended by its muzzle by this short free link chain" (the cannon was one of those stubby cannon used on merchant ships as signal guns). "Now, said Readhefer, "put your feet against this cleat on the floor, take hold of the butt ball of the cannon, and pull it to about the angle I have my weights on the carriages, and tell me if it does not maintain a constant pull, and does not grow lighter." Very soon the man said: "No, I really think it grows heavier, and pulls harder; but Mr. Readhefer, thee ought to have a great steelyard and suspend the cannon on that, then thee could show if any of the direct down pull or gravity was lost or changed by pulling the cannon out of the perpendicular." "That is a capital thought," said Readhefer, "for if there is any loss it would show what I gain by the angle I load the weight on my carriages." There was much more of this kind of badinage between the plain, simple-minded engineer and Readhefer. I have told this as a continuous story, only intended to convey the general substance; part is from recollection, but probably more from conversations with my father in later years. A conversation between him and my grandfather, after we left Readhefer's exhibition, made a lasting impression. Grandfather asked father if he did not think it a bold thing, and a capital piece of acting in Owen, to play the ignorant inquisitor. My father asked what Owen? The reply was: the fine Welsh machinist and clockmaker that worked with David Rittenhouse until his death, and has pursued clockmaking ever since. My grandfather then said before going into the show he had recognized him by his voice, and that was totally changed after entering the building; he had watched him closely without discovering the least halt or change in his assumed character; since coming out he found Owen hugely enjoying his successful joke, which, he says, he did not undertake with an intention of exposing Readhefer, but only for a little quiet fun; he showed a couple of English silver shillings so bent and shaped that one was so placed in his mouth as to depress the corner, and prevent the play of the muscles about the corner that are so expressive of character; the other was used to modulate his voice and enable him to keep up his assumed character; the only other disguise was the Sunday suit borrowed from Mr. Peale's Scotch gardener—the knit cap, broad collar, square cut, short-waisted coat, and loose trousers covering his ordinary breeches, and silk stockings, and a pair of dirty brogans completed his disguise.

After this long digression I will now try to describe the Readhefer machine, as exhibited, to be understood by the reader without recourse to drawings in illustration. The foundation of the structure was a trap rock bowlder, hollowed out on top sufficiently to form a step-box for an upright shaft. As near as I can recollect, this shaft was some 10 or 12 feet long or high; it was made of wood, say about 12 inches diameter, and octagonal; its step and journals ordinary cast-iron wing gudgeons, the lower one resting in the rock step-box, the upper journal by strap-box to a cross-beam. This shaft was free to revolve, and so arranged with the stone step box, and open strap-box on the upper end, that no power could be possibly applied to either of these journals without being discovered. Near the lower end of this vertical shaft was a strong wooden wheel of about the diameter of the length of the shaft. This was a spur-wheel, with wooden cogs, beautifully constructed, and a fine specimen of the millwright's art. The outer ends of the arms of this wheel were planked over, forming a concentric platform of about two feet wide. For stiffness and stability, light iron suspension rods ran from the arms close to the concentric platform to a spider ring, or wheel, at the upper end of the vertical shaft. On this concentric platform was a narrow-gauge tramway, encircling it. On this tramway were placed several four-wheeled carriages. The platforms of these carriages, on which the propelling weights were placed, were at an angle of about 45° to the tramway. The teeth of this spur-wheel worked into a lantern pinion or trundle-wheel, in early times known by millwrights as a wallower. This was on an upright shaft, on the upper end of which was a crown-wheel, bevel, or miter, driving a horizontal shaft, on which was a V pulley, with a corresponding one on shaft of a grindstone. A round belt of either catgut or rawhide, drawn very tight between the V pulleys. When the weights, which were of lead, and probably as much as forty or fifty pounds each, were placed on the carriages, the big wheel would at first slowly commence to revolve, but would soon acquire what was claimed to be the normal speed due to the weights. Then the credulous crowd were invited to sharpen their knives on the grindstone driven by the untiring perpetual motor that neither consumed fuel or food, and whose lifetime alone depended on the durability of the materials of which it was constructed. Soon a crowd would be pressing to take their turns with their Barlow blades, to be shown as having been ground by the power of Readhefer's great invention, the perpetual motion.

I have but a dim recollection of the discussions, or the opinions expressed by those present at this exhibition of the machine; but many times subsequently I have heard my father state that he had been very positive in advancing his belief in the entire thing being a fraud; that instead of the perpetual motion driving the grindstone, it was being driven by the grindstone, or, in other words, that the shaft of the grindstone was being driven by crank and man power on the other side of the partition.

The grindstone being placed near the partition, its journals, to prevent cutting by the grit from the stone, were covered by roughly made wooden boxes in a manner to convey the idea that it was an after-thought; when the box cover next the partition was removed it was plain to be seen that the grindstone shaft did not reach the partition, but no opportunity was given to caliper this end of the shaft, and if slightly out of round when the box cover was replaced, an undetected connection could be made with the operating crank, and the power be carried to the machine by the tight round belt through the bevel wheels and the lantern pinion. My father said that the wooden cogs of the platform wheel were so nicely made, fitting so closely into the rounds of the lantern pinion, that in the shadow from its top platform it was impossible to see whether the pinion was driving or being driven, that the same might be said of the bevels on upright and horizontal shaft. My father, to satisfy himself, had gone with some slips of soft, damp paper, which, when unobserved, he had inserted between the cogs and the round, and had got ocular demonstration that the lantern pinion was driving, and not driven, and he had become satisfied, and had freely so expressed himself, as to the *modus operandi* of the fraud being practiced. This got to Readhefer's ears, and so excited him that when the legislature appointed a committee, at his own solicitation, to examine and report on his wonderful discovery and invention, he refused to allow the examination until some one was substituted for my grandfather Nathan Sellers, who was named on the committee, on the ground that both he and his son Coleman had so strongly represented the whole thing a fraud and deception that a fair, unbiased report could not be expected with either of them on the committee. I do not know how the matter got before the legislature, or its object. On my inquiries as to the nature of their report, the reply was non-committal. They had seen the machine in motion, had heard the charges of fraud, but, if one, they had failed to discover it.

Though nothing of value had come from the motor, the interest in it had not abated, and it was still a successful exhibition, crowds daily visiting it. One day on hearing loud talking in my father's office, and what sounded to me as insolence to him, I went forward in time to hear Readhefer say to him, "Your charging me with fraud has done me great injury, and I insist on your coming and bringing with you whoever you choose, and I will convince you and them that my perpetual motor drives the grindstone; you may cast the belt, or do whatever you like." My father, who seemed hurt by the language that had been used, believing it was due to Readhefer to give him the chance, reluctantly agreed, and a time was fixed. My father took with him my uncle, Reubens Peale, Isaiah Lukens,

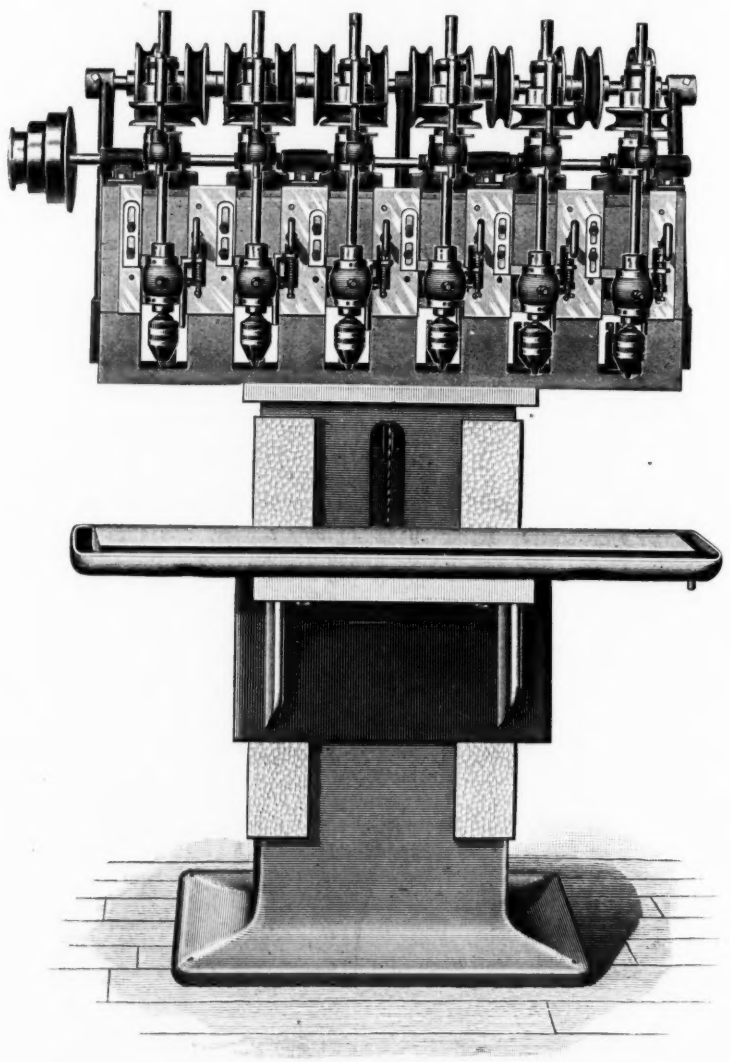
and, I think, either Wm. Mason or Rufus Tyler—most probably the latter, as he was the most frequent visitor at our house, and the open-front carriage my father drove only carried four persons. Lukens was the town clock maker and general machinist; no man of that period better known, or held in higher estimation. Both Mason and Tyler were accomplished machinists, makers of the highest order of philosophical instruments, fine-class foot lathes, slide rests and models. I have often heard Lukens relate the incidents of this visit in a most humorous way, made more so by his impediment in speech, when telling anything exciting.

They found the grindstone removed from its position near the partition, the belt cast, the stone standing, and the motor running; the only change my father observed was in the position of the bevel wheels—the crown wheel that had been under that of the horizontal shaft was now on top. This change Readhefer explained as having been made to admit of being thrown out of gear, on raising the shaft out of its step-box, that the length of the rounds of the lantern pinion admitted of his doing so; he thought that would convince Coleman Sellers that the power that ran his motor did not come by the way of the grindstone, but was due entirely to the weights on the carriages. The machine was stopped, and propped to prevent starting; the shaft was raised sufficiently out of its step-box, as Lukens used to describe it, to admit of passing a knife blade under; that was all the rounds of the lantern pinion would allow, but, as Lukens said, not sufficient to let him put his finger under, to feel if the bottom of the shaft was not like the pipe of a watch key, that, on being lowered, would connect with the power, that, on signal, might start in the adjoining room. Then he, without giving any reason for so doing, was about asking of Readhefer the privilege of taking the upright shaft down with its lantern pinion, and allowing the machine to run without that appendage, when he was interrupted by my father saying to Readhefer, "Your machine is beautifully finished in all its parts; why was it not carried out in this?" putting his cane on a plank or timber rather roughly hewed, showing the marks of the broadaxe. To this Readhefer's reply was, "I was in a hurry making the changes, and as it is entirely outside, and not connected with or essential to the machine, I let it go." "Yes, yes, I see it is not, but it does not seem to be securely fastened, and could be easily removed without the least injury to the machine; if you will sell it to me, and let me take it up now, I will give you one hundred dollars for it, and you can replace it for less than one dollar." It was here, in telling the story, that Lukens, in his inimitable way, mimicked Readhefer's rage, when indignantly rejecting an offer that he took as an insult. The telling was so amusing that we never tired of hearing it repeated. Father had rightly surmised that the plank in question covered the entire secret.

Reubens Peale was at that time manager of the Philadelphia Museum, belonging to his father; he conceived the idea that the furor raised by Readhefer might be turned to advantage, if a working model of the perpetual motion could be so constructed that the power moving it could not be discovered, it would prove attractive. This Isaiah Lukens undertook to do, and made rather a rude working model. This, I think, is still in existence in the collection of the Franklin Institute of Philadelphia. This did not carry out the perfect deception required, and in its exhibition needed the constant attention of some one to manipulate it, to stop on the removal of the weights, and to start on their being replaced. The lower journal or step of the upright rested on a plate glass that could be removed, and the upright with its platform wheel raised or lowered, but would hold this shaft perpendicular. Above this glass step there was a light bridge, but heavy enough to have the power from clock work in the base by light, delicate gearing, to carry the power to the upright through it; this was a step in the right direction, but it did not meet the case. But to make a working model that would start on placing the weights on the inclined beds of the railway carriages, and stop on removing them—this was the problem that Lukens undertook to, and did solve, in so ingenious a way that the deception was perfect, and to my knowledge never discovered, though repeatedly examined by the most thorough and ingenious men of that period.

The beautiful machine he made for the Philadelphia Museum was mostly of mahogany; it had a massive rectangular base, within which the clock spring and gearing was concealed; at each corner of the base rose a mahogany column, each column above its entablature finished by a mahogany ball; from one of these balls a steel rod passed down through the center of the column to the gearing in the base, making it by the ball a "stem winder." Diagonally from the column were the beams to carry the glass box for the upper journal of the main upright shaft, which was of wood, octagonal, in imitation of Readhefer's, with wing gudgeons for both lower step and upper journal. The lower step journal was of much greater diameter than the upper, in model, as near as I recollect, about ½" or ⅝" diameter. Both upper and lower, being of transparent glass, could be seen through, to show that there was no possible connection with the shaft. The lower or step-box was, as seen, a large square plate of glass firmly fixed in the base of the machine, with a hole in its center to fit and receive the lower gudgeon; this step-box was two separate plates of glass, the upper square one secured to the base had the hole for the gudgeon bored entirely through it; the lower plate was solid, circular, and in close contact with the upper; it was mounted in a revolving ring carried by arms from a vertical shaft with regular boxes and step, and driven by a train of spur wheels from the clock-work, which kept it constantly revolving. The lower wing gudgeon of the perpetual motion was made of hardened steel, and highly polished, the upper journal long enough to allow the shaft to be sufficiently raised as to lift the lower one entirely out of the step-box, and be examined. The end of the lower gudgeon was ground off to so slight a bevel that it could not be perceived, but the weight of the upright with its platform and cars, in reality, only rested on the outer edge of one side of it, and their weight was not sufficient to cause adhesion sufficient for the revolving glass to transmit its motion to them, but when the leaden weights were placed on the inclined beds of the carriages it would slowly start, and soon get up to its normal speed; this slow starting, taken in connection with the large space, giving the chance at all times to see through the glass boxes made the deception complete, and as I have before stated, was never discovered.

The machine was enclosed in a glass case and when the museum was in the old State House, or Independence Hall, it was in the care of old Moses, the profile or silhouette cutter of the museum, whose duty was to see that the clock-work never ran down during the hours of exhibition. He would open the case, and allow inquiring visitors to remove and replace the weights; he told of Readhefer asking this privelege, then sitting for hours watching the machine running, and all the time talking to himself, the gist of which, as far as "Moses" understood, was, Lukens has hit it, and proved my theory right. Lukens told of Readhefer having called on him, and began by abusing him for having stolen his invention, and robbing him of the income he made by its exhibition; that people instead of going out to Germantown, now all went to the museum. Lukens reminded him that stealing and robbing were ugly words that he would not allow, that then Readhefer changed his tactics, and proposed a union of interests, saying that he. Lukens, by skill and superior workmanship, had accomplished what he was aiming to do, and that by a union large sums of money could be made. Lukens said he told him that he would have nothing to do with money made in that way; he had made the machine for Mr. Peale, and had been paid for its cost and the time he spent on it, and that was all he should ever make. They had never claimed it to be a perpetual motion, but simply a model of a machine that he, Readhefer, was exhibiting as such. Readhefer persisted in expressing his belief that Lukens had solved the question, and that there could be no trick in the museum machine. Lukens had said, "If you believe so, go back to the museum, have Moses open the case, take off the weights, and it will then stop; then reverse the carriages, replace the weights, you will find it will start and continue to run in the same direction it was running, directly the opposite to what it should, if your incline loaded static weights were the propelling power. If that don't satisfy that the angle or inclination of the weights has nothing to do with the running of the machine, just load them onto the platform wheel in any position you choose, and the thing will run just the same; they make it run, and it won't run without them." I have never seen any published account of the device Lukens adopted to carry on for so long a period so perfect a deception. At one of the early meetings of the Franklin Institute, he fully explained and illustrated it. I do not know what became of the museum model, but I have the impression that it became the property of Barnum, and was burned with his Philadelphia collection in the Wm. Swain Building at the S. E. corner of Chestnut and 7th streets.



SIX-SPINDLE DRILL.

Some Improved "Hendey" Tools.

The accompanying illustration is of a recently improved six-spindle drill press brought out by the Hendey Machine Company, of Torrington, Conn., the most prominent feature among the changes being the widening of the column, with the object of giving the best possible support to the machine, and to the table, which is also made much heavier than formerly, clamped to the column at the rear and counterbalanced.

The spindles are driven by round belts, each one being entirely independent of all the others, so that it can be stopped and started without reference to the rest of the machine. Holes may be drilled up to ⅝ inch diameter, and the feed of the spindles is 2½ inches.

The feed is automatic, and can be set to drill any desired depth, at which point the feed is automatically released and the spindle returns to its position, and remains there until again brought to the work by the operator.

The grooved pulleys seen at the back of the machine on the horizontal shaft are simply idlers that serve to guide the belt to a countershaft, which may be in any convenient position.

There are two countershafts, each having four stepped pulleys for different sized drills, the range of speed for the spindles being from 250 to 270 revolutions. The vertical movement of the table on column is 18 inches.

On page 5 we give illustrations of a shaper and planer built by the same company, the shaper being of 15-inch stroke, with a cross-feed of 15 inches, and capable of planing a piece of work 14 inches high.

The driving motion is the same as regularly used on the Hendey shaper, there being a friction device by which the ram is driven, securing an absolutely uniform motion throughout the stroke, and accurate reversal at any desired point.

There are two racks under the ram, which are driven by two gears or pinions on the same shaft, separated sufficiently to allow of a piece of work being put through for key-seating.

The table is hinged at the top, and can be set at any inclination for producing taper work, when desired, a stop fixing its correct position for parallel work. The machine is fitted with ordinary solid table, if desired. The vise will hold work up to 8 inches. Weight of machine 1,300 pounds.

The planer is of 16 inches capacity, with 4-foot platen, the bed being of the truss form, mounted on box legs to secure solidity.

The bushings for the shafts of the driving mechanism pass through the uprights and bed, into which they fit tightly in reamed holes. These, in addition to the bolts similarly fitted in place, give a very rigid attachment, while at the same time securing a very firm support for the shaft bushings.

The driving mechanism is the same as that described for the shaper above, but where preferred the regular shifting belt device is substituted, the belts being shifted by cams in the most approved manner. Weight of machine, about 2,400 pounds.

LETTERS FROM PRACTICAL MEN.

Magnetism in Drills—The Premium Plan of Paying for Labor—Foremen.

Editor American Machinist:

Since writing in regard to the magnetism displayed by the drills used on different metals, I have received from a friend in the South a suggestion that it is due to heat—in other words, that magnetism is heat. While not being prepared to disprove this theory, it has some weak points as I look at it. While the thermal battery or thermo-pile generates electric current, and the pile necessarily has poles, it does not seem that these poles can be termed magnetic. And, to follow another line of investigation in this respect, we find that when a permanent magnet is heated it loses its magnetism instead of gaining strength, as it should if the heat theory was the correct one. Whether the different polarity shown by contact with different metals is due to the thermal couple must be determined by those more expert in battery lore than I; it is only offered as a suggestion.

Since making the tests as described some time ago, it has been found that a few of the drills used on brass work had changed polarity, without having, to my knowledge, been used on any other metal. If it is proved that the polarity is a constant depending on the metal, it might prove an easy method of determining to what use a drill or other tool had been put. Whether this change has been due to contact with drills of the opposite polarity cannot be stated. It was suggested by James Francis that experiments be tried with left-handed drills, and in accordance with his suggestion a pair of left-handed drills were made and tried to a limited extent, not enough, however, to satisfy the writer fully in regard to the result.

A limited trial showed an apparent change in the one used on brass, while the other appears to remain the same; further trial may change this result. It may not be uninteresting to state that the drills before use showed marked polarity, though there had been no magnetic contact nor proximity to electric current.

The paper read by Mr. F. A. Halsey, at the Providence meeting of Mechanical Engineers, and printed in your issue of June 18, is well worth the careful study of all interested in the welfare and advancement of the mechanic and all other workmen.

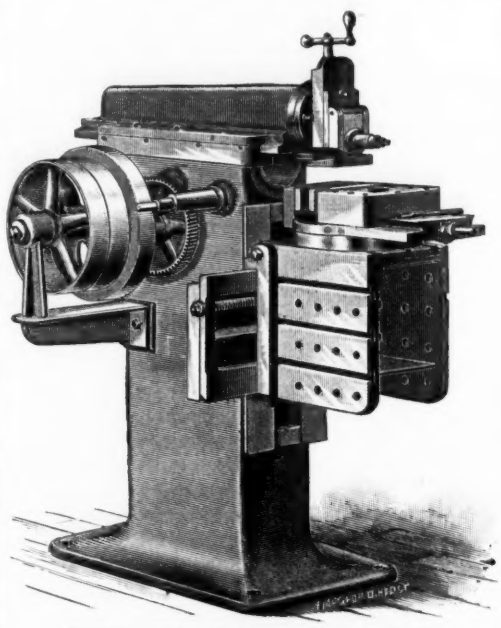
It well describes the piece-work system, and though I have always considered it the best when honestly applied, the system proposed by him seems to present additional advantages, and removes some if not all of the drawbacks.

There are many cases where a piece of work is rendered useless by the discovery of a defect in the casting, oftentimes after the work is all completed and is ready for shipment. The testing shows the defect. In this case it is no fault of the workman, and it is not fair for him to lose his wages. As the employer loses the work, it is a loss to him as well, but that is not the question; rather the attitude of the employer to the men. It sometimes happens that the defect is discovered during the operation and delays the work; in fact, it is lost or else causes the work to be delayed till the defect can be remedied.

The system seems to be a very equitable one, and should grow in favor. It is by this method that the eight-hour question must be settled; both sides must compromise, for neither can be expected to cede all the points in question.

The following case illustrates one of the evil tendencies of piece-work that too often follows its adoption. Wishing to have the shop run on a system of piece-work, all work was reduced to that standard, not reducing wages necessarily, but a fixed price was set for all work. One of the workmen was a steady man who worked all the time, and who was making good wages, which were guaranteed by the foreman to remain as high, at least, under the new system.

To the surprise of all, the man himself included, he soon was drawing much larger pay than ever before, sometimes as much as 50 per cent. additional. Those who have worked at piece-work for any length of time will remark that he was foolish to turn



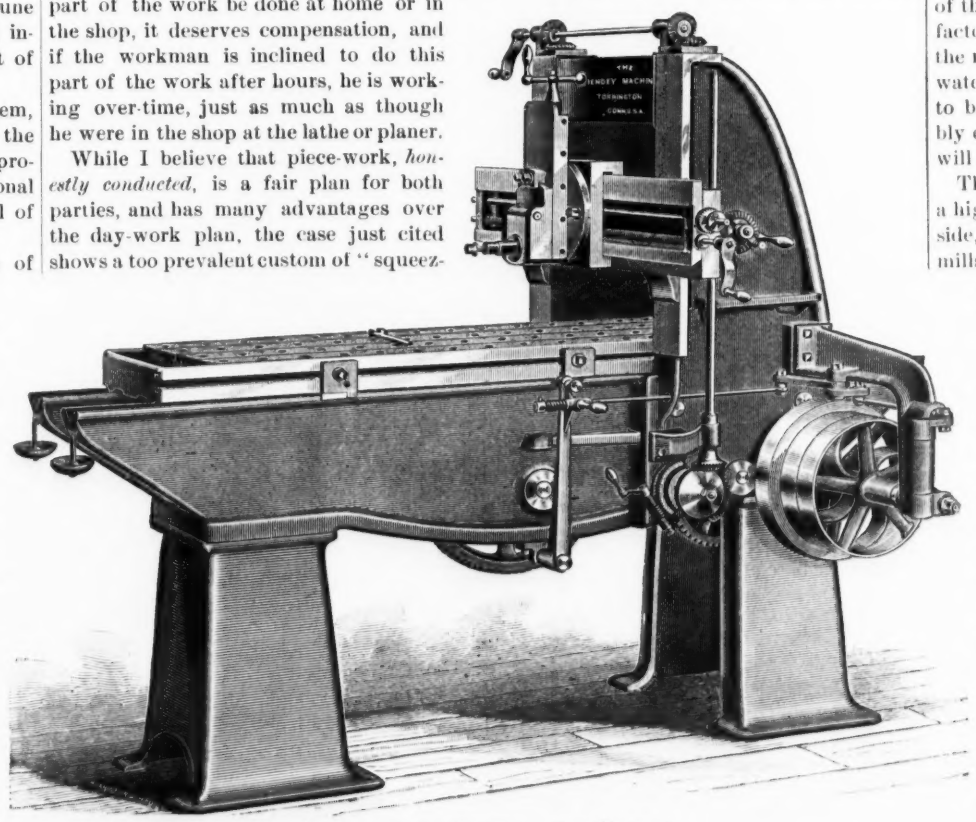
FIFTEEN-INCH SHAPER.—SEE PAGE 4.

out so much work, as it is sure to be followed by a reduction.

The foreman explains it as follows: "Under the old system the man did his planning and thinking in working hours; now he does all his head work at night and devotes all his time days to the work itself." It is needless to add that he will be cut down before long, as he is "making too much money at present"; but it is hard to see where the justice of this seemingly inevitable act comes in. Of course he is making more money than formerly, but simply because he earns more; it is not a gift by a benevolent firm, but actual earnings, just as it was before.

Because he does his mental work at home is no reason that he should not receive pay for it, and taking the foreman's explanation as the true one, as it probably is, it does not justify any reduction. Whether the mental part of the work be done at home or in the shop, it deserves compensation, and if the workman is inclined to do this part of the work after hours, he is working over-time, just as much as though he were in the shop at the lathe or planer.

While I believe that piece-work, *honestly conducted*, is a fair plan for both parties, and has many advantages over the day-work plan, the case just cited shows a too prevalent custom of "squeezing" that seems to be considered a regular part of the piece-work system, although it does not necessarily belong to it, but is one of the unfortunate barnacles that it gathers at the hands of men who do not seem to know what justice means.



SIXTEEN-INCH PLANER.—SEE PAGE 4.

When the work is being produced at a faster rate than formerly, it is costing the proprietor less for its production, even though he is paying the same rate per piece for the work, for he is turning out more work at the same cost (or nearly so) for power, and without increasing his plant. To expect more than this seems to be bordering on the grasping and miserly idea.

On the other hand, labor, as all other commodities on the market, is subject to the law of supply and demand, and when it is found that a man is earning more than the market price for labor, a reduction is usually sure to follow.

Mr. Halsey's plan seems to be the best one so far proposed, and the practical workings of this system will be watched with interest. Any work that can be done by piece-work can be done by this plan as well, and from the fairness of the plan we might say done better.

The letters from "Uncle Ben" are among the most interesting articles that have appeared in the AMERICAN MACHINIST for some time, being so pertinent and full of advice that a young foreman needs so much, and those who are not foremen can also read them with profit. It is needless to say that the writer of them has had some experience, for it would seem impossible for any one to write as he does that had not been there himself. His situations are real, and of frequent occurrence, which makes the advice all the more acceptable.

The plan of bringing in an outsider to superintend a shop is a question to be decided as the case in hand warrants. It is not very encouraging to a man to work for years in a shop, learn all the ways and methods of doing work, and then have a stranger step in and fill the vacancy that seems to belong to him.

On the other hand, the man in question may be a good man for the work, yet not capable of estimating on contracts, nor able to handle men to the best advantage. If he can be made to see these points his feelings may be saved in a measure.

There is also another side to the question. There are few men that can manage men whom they are acquainted with as well as strangers, especially when they have always worked with them and been one of them. It is always harder for the foreman when he comes from the ranks of the shop. He cannot have the same feeling in regard to the men, for he is also looking to the interest of the firm, and cannot overlook failings as formerly, when it was none of his affair if a man only worked half the time. It is no easy task to tell a friend of yours that he is not working as he ought, yet duty demands that it be done, and he always thinks that you might let him take it easy, as you have been friends for so long. There is always the feeling that you don't have to work, now that you are "boss," and you ought not to object if they take it easy as well as yourself; you were boys together, you know. It is easier for any man to go into a new shop as foreman than to be promoted to that position in the same shop that he has worked in for years. Every trait of yours is remembered, and they gather interest as the days go by. "You ought not to kick; you used to do the same thing before you got to be foreman"; and this last carries a sneer usually, not the pleasantest thing in the world to hear several times a day. It is a sort of bulldozing that is indulged in as a special privilege for knowing you before you were considered competent to fill your present position, or before the opportunity offered.

I recall one case where a workman was given to whistling loudly, to the great discomfort of the foreman, who, however, was powerless to stop him, as he was in with the proprietor. Time went on and the whistler got to be foreman. He finds that it is not pleasant to have this noise in his ears when he is busily engaged in estimating or planning out some work, and he takes measures to have it stopped—posts notices, etc. As notices are usually a dead letter, this does not help matters much, and it is hard indeed to convince men that you are in earnest, and they cannot think you will discharge them for doing the very thing you have done so many times when there was another foreman. All these things go to make it hard for the new foreman, who has risen from the ranks, and taking these conditions into consideration, it is not to be wondered at that foremen are chosen from other shops. As in all other questions, there are two or more sides to be considered, and it is not wise to pronounce judgment until all sides have been investigated.

FRED H. COLVIN.

Utilizing Niagara.

Editor American Machinist:

Doubtless many people have heard of the scheme to "harness Niagara," but few know by what means this immense natural power is to be utilized.

In the first place, the beauty and grandeur of the falls will not be impaired, as the mills, factories, etc., will be some distance from the river and falls. Nor will the volume of water which passes over the falls (estimated to be one million tons an hour) be perceptibly diminished, as less than one per cent. will be utilized.

The present milling district is situated on a high cliff below the falls on the American side, and comprises flour, paper and pulp mills, a chain factory, book bindery, brewery and machine shop. The water which furnishes power for these factories is brought through a surface canal, from a point above the falls, and the "tail-water" is discharged over the cliff. The power derived is very great. For instance, a 24-inch turbine wheel under a 60-foot head develops 360 horse-power, while another wheel of larger diameter furnishes 1,000 horse-power. The cost of running these mills is about five dollars per horse-power per year, for 24 hours a day. The plant now under construction by the "Niagara Falls Power Company" is very elaborate, and is an immense undertaking. It consists of a tunnel 29 feet in height, and 18 feet in width, extending from a point below the falls, 200 feet under the village of Niagara Falls, to a point one mile and a fourth above, where it is 165 feet below the surface of the river. Here a canal will be built directly over the line of the tunnel, and, drawing water from the river, will discharge it, with a head of 120 feet, into penstocks, then through turbine wheels into the tunnel below. Lateral conduits will be cut, connecting the mills with the main tunnel. All of these tunnels will be cut through the solid rock, and lined with brick. They propose having wheels developing as much as

2,000 horse-power. These wheels will be 10 feet in diameter, and will work under a head of 60 feet 3 inches. The total power produced is estimated to be 120,000 horse-power, and is equal to the combined water power of Lawrence, Lowell, Holyoke, Turner's Falls, Manchester, Bellow's Falls, Lewiston, Cohoes, Oswego, Paterson, Augusta, Ga., Minneapolis, Rochester and Lockport. The power developed by the wheels will be transmitted direct, or by electricity, rope drives, or compressed air, whichever is the most suitable. Water will be rented to those desiring to build their own penstocks and wheels, and to others power will be furnished from stations erected by the company.

The work is being carried on as rapidly as possible, but is of such a nature that only a limited number of men can work at a time. However, the company expect to have it completed by January, '93, and be able to furnish water power to those who will avail themselves of this magnificent source of energy.

H. C. S.

Boring Tool.

Editor American Machinist:

Herewith find sketch of a boring tool that I devised several years ago. It is not patented.

The enclosed sketch will show the construction of the tool: *A* is the bar, *B* the finishing cutter, *C* the roughing cutter, *D* the guide collar to follow the hole to be enlarged, *E* the nut, *F* screw to center cutter.

JAMES H. WELLS.

Oil on Planer Slides—Finishing a Curved Table.

Editor American Machinist:

Some time ago "Jarno" told us that if a planing machine stood idle during the night with a cut on, it would leave a mark in the work, and he attributed it to the falling of the oil to the bottom of the V's.

This may be true to a certain extent I think, however, that it is caused more by expansion and contraction of the metal than by anything else.

When you stop the machine at quitting time, both the tool and the work are hot, and in the morning (particularly in the winter) they are both very much contracted.

If it were due simply to the oil in the V's, or rather the absence of oil in the V's, how is it, when taking a cut down the side of a piece of work, the same thing occurs?

The oil falling in the V's would simply lower the table, which of itself would hardly make any difference in the cut down the side.

A short time ago I saw a lathesman turning a curved table. He strapped the table onto the carriage, and put a cast-iron bar or shaft between the centers. The shaft was rough, with the exception of about 5" near the center, which was turned slightly tapering, so as to hold an arrangement which looked very much like a blank wheel (Fig. 1). This served as a tool holder.

He used only one tool, which was making immense sweeps through thin air, and then, down near the end of each revolution, it would take a fine cut from off the table. I don't suppose that the tool was cutting more than one-eighth the distance traveled in each revolution. I asked the man who was doing the job how long it took him to finish a table; he told me "about two days."

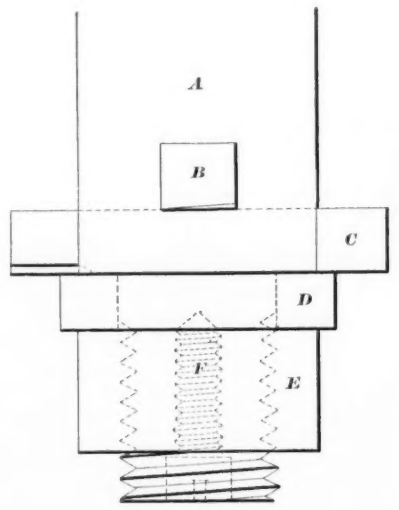
Now, if he had put another tool on the opposite side of his blank wheel arrangement, he could have done the job in about one-half the time, and if he had put in four tools (Fig. 2), equally distant from and slightly in advance of each other, each tool taking a cut of itself, independent of any of the others, he might have finished the job in little over half a day, allowing some time for setting the job itself. It seems that he had to take several cuts over the table, the work being so light that he could not take a heavy cut with one tool, so he might have used the four tools, and, by using the last tool for a finishing cut, he might have finished the job by what would practically be one cut. I don't suppose that this is a new idea, but it goes to show what might be accomplished if a man is willing to exercise his thinking powers, and not work in the same rut in which those about him are working.

CHARLES STELZLE.

The Industrial University.

Editor American Machinist:

The criticisms and answers brought out by the mention of an Industrial University, by Prof. John E. Sweet, have been of much interest to me. I am fortunate enough to have three sons between the ages of 14 and 20 years, one of whom has had as good a shop training as could be obtained at his age, both in my own shop and that of another large manufacturing establishment, but lacks just the technical training that such a school would give him. I hope to give it to him in the near future, and am not able to pay a fancy price for it, either. My experience in the past, as well as at the present time, in securing proficient help, has established the fact that help with the knowledge of drawing and mathematics is preferable to help without these acquirements, as a man who can make a good practical drawing can read and work from one much better than one who cannot make the same. My experience, as well as that of others with whom I have talked on the subject, is to the effect that there is no end to the want of first-class men who thoroughly understand the work before them, and that there are no places left open to those who do not. I, in the capacity of superintendent of a manufacturing establishment, have daily to refuse employment to the latter class, while it is impossible to get first-class men. I have to resort to all available resources, and have frequently asked Mr. Sweet for just such help.



BORING TOOL.

F. A. HOLLENBECK,
Sup't Baker Gun Co.

Batavia, N. Y.

An Improvement on a Surface Gauge.

Editor American Machinist:

We see lots of novelties in the way of surface gauges, but very few real improvements. I think I have got here a little improvement, for we can do something with this gauge that can't be done with others. We can line up the side surface as well as the top.

Several years ago I put a little rib, as shown at *A*, on the base of my gauge, and have found it a real improvement. I dovetailed mine in, but I think it could be fastened about as well with two screws, except that it might not be so handy in taking off and putting on. I use this in the slots, in planer platen or against the ribs, and with the points in some such position as shown I have no trouble in adjusting it.

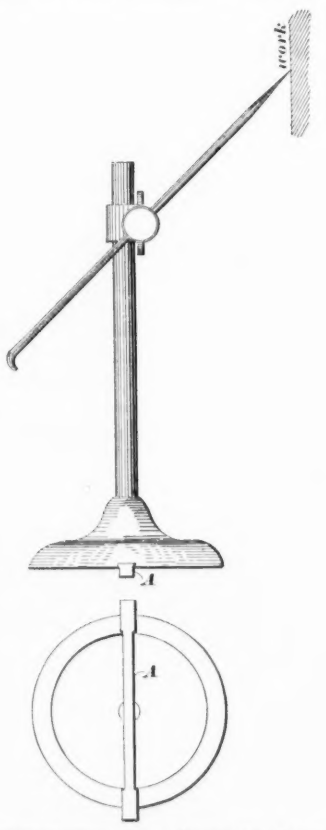
A MECHANIC.

The State of New Jersey requires all railroad companies to furnish a detailed account of all accidents on their property. The result for the past year, according to the figures of *The Evening Post*, is as follows: On the 2,000 miles of railway within the State, 1,604 accidents were reported, of which 317 were fatal; 373 car-couplers lost thumbs, fingers, arms or feet; 292 people were struck while walking the tracks. Of these, 129 were killed, or died after the accident; 113 people were struck by passing trains while stepping in front of them. Of these, 49 were killed and 64 survived their injuries; 46 people were killed in attempting to get on and off of moving trains, while 139 were seriously injured in this way. Of the whole number of accidents recorded, 38 persons were killed and 297 injured on the Central Railroad of New Jersey. On the Morris & Essex Railroad 35 were killed and 96 injured. There were 62 accidents on the West Shore Railroad, a large proportion of which were fatal.

Steel Twin-screw Vessel for the Quartermaster's Department, U. S. A.

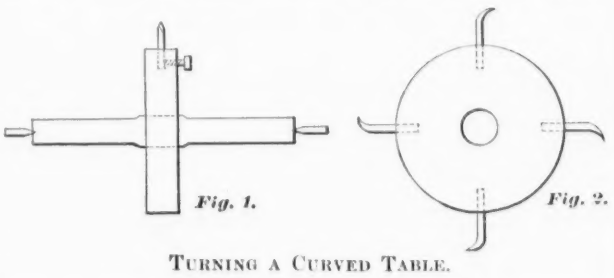
A contract for building a steel twin-screw vessel for the Quartermaster's Department, U. S. A., to be used in harbor service, has recently been awarded to Mr. H. Dialogue, Camden, N. J. Our illustration shows the general arrangement of machinery and construction of hull. The principal dimensions and data are as follows:

Each propeller is to be driven by an inverted compound engine; high-pressure cylinder, 14 inches diameter; low-pressure cylinder, 26 inches diameter and 18 inches stroke. The high-pressure valves are to be of cast-iron, arranged with cut-off valves on main valves,



IMPROVEMENT ON A SURFACE GAUGE.

operated with right and left-hand screws; low-pressure valves, double-ported. The valves are to be operated through a link motion; links are to be of the double-bar type, wrought-iron. Eccentrics and straps are to be made of cast-iron; eccentric rod, wrought-iron, and valve stems of steel, connected to link block with box, strap, gib and key. The cast-iron columns on condenser side of engine are to be fitted with water slides; front columns to be of wrought-iron, finished, bolted to beds and to seatings on cylinders. The bed plates are to be at least 12 inches deep under boxes, each to be fitted with four main bearings. The sides of bed next to condenser are to have flanges, and bolted to the flanges cast to the condenser. Main boxes of cast-iron, babbitted. Condenser to be of cast-iron, and to have 800 square feet of cooling surface; tubes to be of brass, tinned inside and out; tube sheets to be of composition; packing glands to be of composition. Tubes to be arranged in three sections, the refrigerating water to pass through each section. Independent air-pump; steam cylinder, 10 inches diameter; air cylinder, 14 inches diameter, 12 inches stroke. Independent circulating pump; steam cylinders, 10 inches diameter; water cylinder, 12 inches diameter; stroke, 12 inches; circulating cylinder of composition. Exhaust of air and circulating pump to be piped to receivers and to condenser. Piston rods of mild steel, 2½ inches diameter. Crossheads of wrought-iron, with journals forged on. Shoe of cast-iron, babbitted and bolted to crosshead. Connecting rods of wrought-iron, 45 inches long; crank-pin bearing, 5¾ inches diameter, 6 inches long; crosshead bearing, 2½ inches diameter, 3 inches long. Crosshead boxes of composition; crank-pin boxes of composition, babbitted. Crank-shafts of the built-up type. Shafts and pins of steel, slabs of wrought-iron, couplings forged on shafts. Line shafts, 5½ inches diameter, couplings forged on. Propeller shafts, 5¾ inches diameter, covered from inboard stuffing-box to outer end with composition. Couplings on these shafts are to be of wrought-iron shrunk on. Stern tubes of wrought-iron pipe; each is to have at inner end a large cast-iron flange, to be secured to transom. The outboard end to be screwed into a cast-iron stern bearing, which is to be bushed with composition, fitted with lignum-vitæ staves, end wood to bearing. The outer end of casting is to be fitted with a wrought-iron nut. Outer hangers of wrought iron, legs of oval section, 6x2 inches, secured to hull. Eye of hanger, 12 inches long, to have a composition bush, lined like the stern bearing with lignum-vitæ. Propeller wheels of cast-iron, 5 feet diameter, 7 feet 6 inches pitch, one right-hand, one left-hand, to be counterbored to go over composition sleeve on shaft, each one to be secured to shaft with longitudinal key, and 1½-inch composition tap bolt in end of shaft. Main steam, feed and pipes from condenser, circulating, air-pump and blow-offs to be of copper; tank and bilge pipes to be of galvanized iron; piping for steam to pumps to be of composition. A reversing engine is to be fitted to each main engine and operated from engine platform.



TURNING A CURVED TABLE.

There will be two boilers, 7 feet 7¾ inches diameter, 17 feet long. Each boiler will have two furnaces, 36 inches inside diameter, 7 feet 6 inches long from front head to connection sheet. There are to be 168 tubes in each boiler, 3 inches diameter, 7 feet long, No. 10 B. W. G. Shell is to be made of $\frac{5}{16}$ Siemens-Martin steel; heads, ½ inch; tube sheets, ½ inch; furnaces, ½ inch, and connection ½ inch thick. Working pressure, 110 pounds per square inch. The boilers are to be subjected to a hydrostatic pressure of 165 pounds per square inch.

Dimensions of hull:

Length on deck, 132 feet.

Length on load line, 124 feet.

Beam, 26 feet.

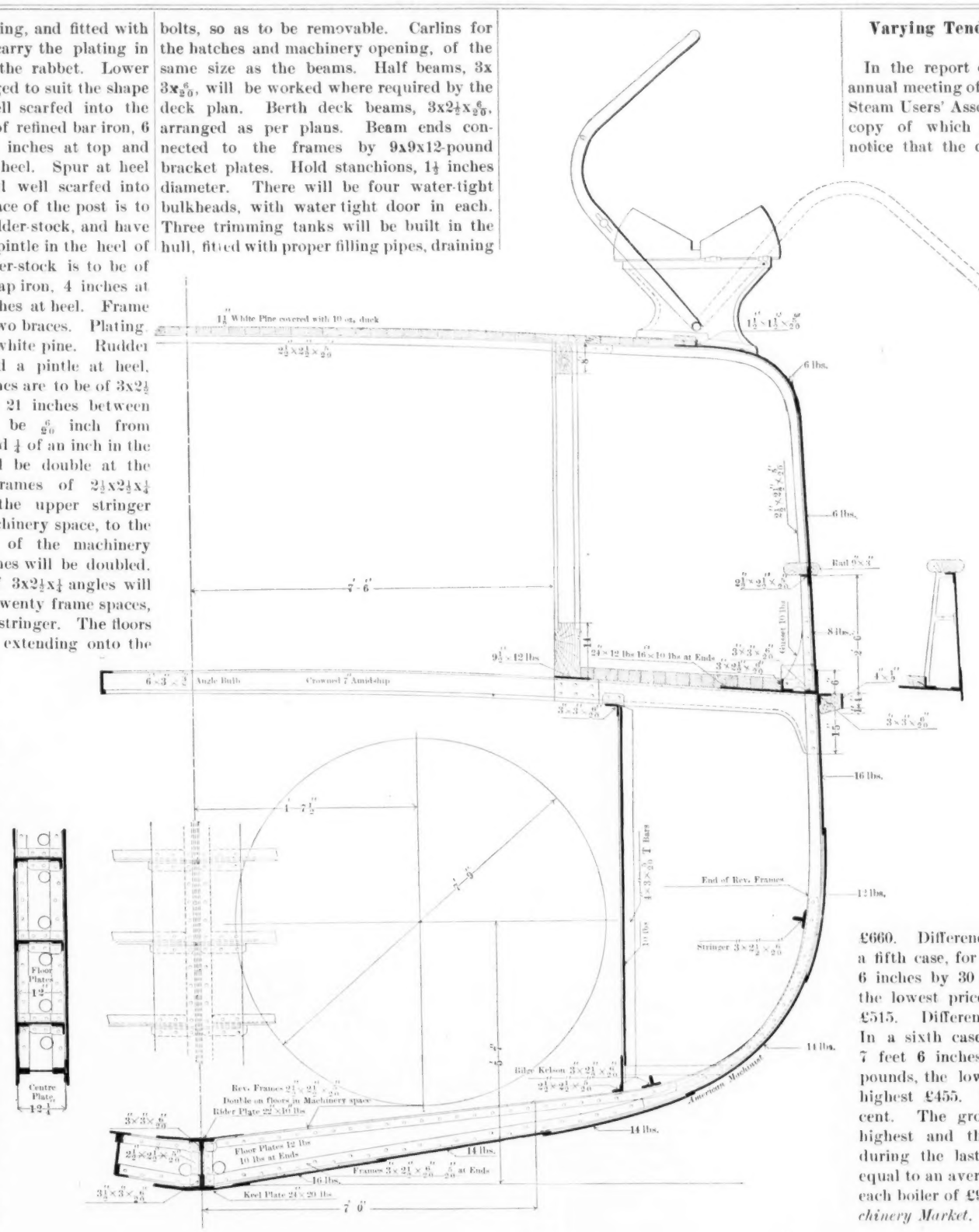
Depth, gunwale to keel, amidships, 10½ feet.

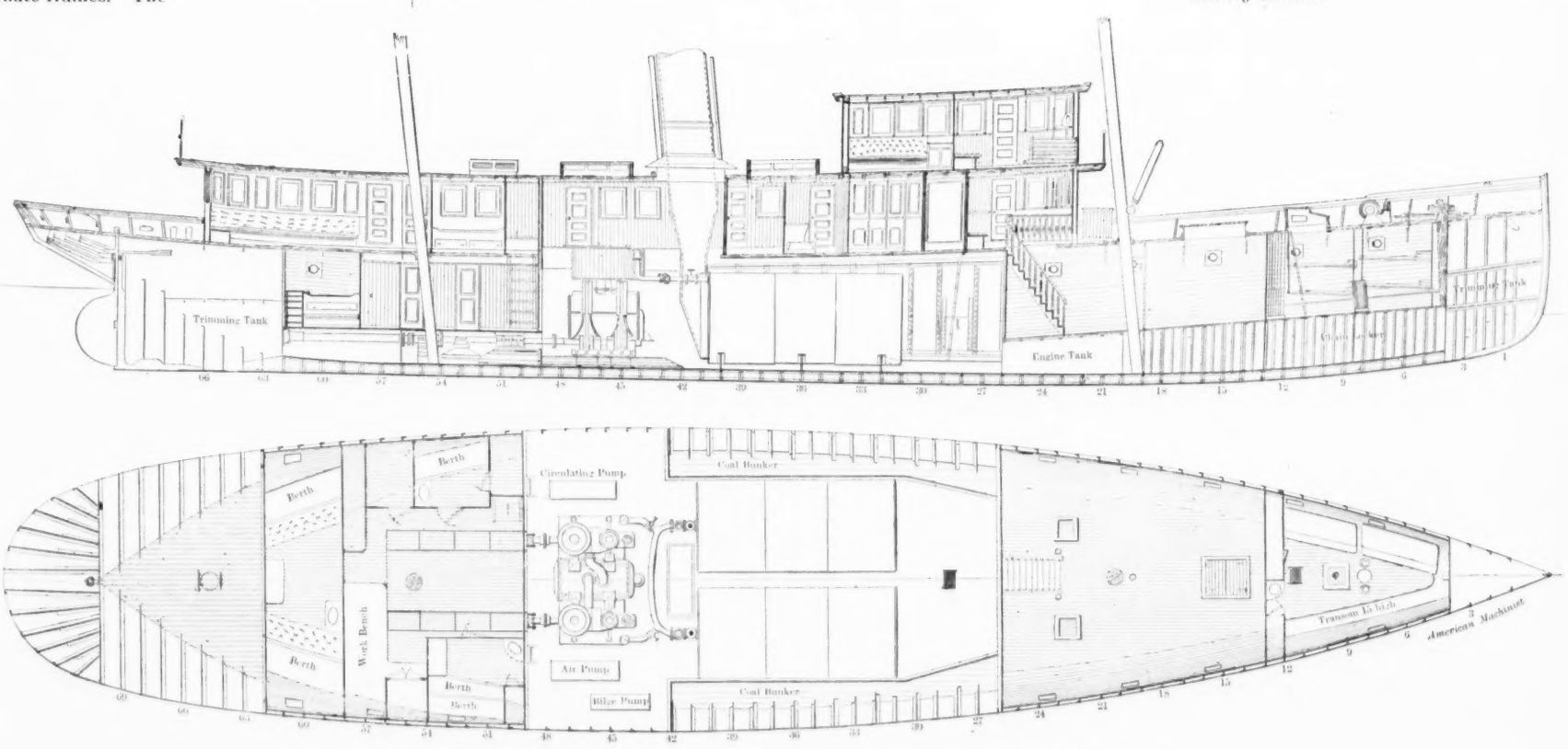
Draught, loaded, 7 feet.

All the materials used in the construction of the vessel, unless otherwise specified, will be Siemens-Martin steel, which shall have a tensile strength of not less than 62,000 pounds, nor more than 72,000 pounds per square inch of section. Samples must show an elongation before fracture of 16 per cent. on pieces 9 inches long, and must be capable of passing the usual hot and cold bending tests.

The keel is to be made of plates 24 inches wide, worked in lengths not less than nine frame spaces. Butt straps treble-riveted. The vertical keel plates will be 12¼ inches deep, worked in as long lengths as possible. Stem of refined bar iron, 6x1½ inches, rab-

beted to receive the plating, and fitted with wedge-shaped liners to carry the plating in perfectly fair lines into the rabbet. Lower end of stem is to be forged to suit the shape of the design, and well scarfed into the keel plate. Stern post of refined bar iron, 6 inches molded, sided 3 inches at top and tapered to 1½ inches at heel. Spur at heel to extend forward, and well scarfed into keel plate. The after face of the post is to be grooved to fit the rudder-stock, and have a lug at heel to receive pintle in the heel of the rudder. The rudder-stock is to be of the best hammered scrap iron, 4 inches at head, tapered to 1½ inches at heel. Frame forged to shape, with two braces. Plating 10 pounds. Filling of white pine. Rudder hung with a strap, and a pintle at heel, properly bushed. Frames are to be of 3x2½ inch angle iron, spaced 21 inches between centers. Thickness to be $\frac{6}{20}$ inch from frame 18 to frame 61, and ¼ of an inch in the ends. The frames will be double at the bulkheads. Reverse frames of 2½x2½x¼ angles, extending to the upper stringer angles; and in the machinery space, to the deck. Over the floor of the machinery space, the reverse frames will be doubled. Intermediate frames of 3x2½x¼ angles will be worked in the first twenty frame spaces, extending to the upper stringer. The floors will be 12¼ inches deep, extending onto the turn of the bilge, and connected to the keel plates and rider by 2½x2½x¼ angles. Limber holes will be cut in the floors and vertical plate. Bilge keelson and hold stringer are to be formed of a pair of 3x2½x$\frac{6}{20}$ angles, back to back, riveted to reverse frames and to clips of the same weight as the reverse frames. The plating is to be worked in six in-and-out strakes; plates to be not less than six frame spaces in length. Butt covers 2 pounds heavier than the plates they connect. Garboard and keel laps to be double-riveted; the remaining laps, single-riveted. Deck beams of angle bulbs, 6x3x$\frac{6}{20}$, arranged on alternate frames. The beam ends will be split, turned down, and a piece welded in to form brackets 15 inches deep. Over the boilers the beams will be jointed, and the laps secured with screw bolts, so as to be removable. Carlins for the hatches and machinery opening, of the same size as the beams. Half beams, 3x3x$\frac{6}{20}$, will be worked where required by the deck plan. Berth deck beams, 3x2½x$\frac{6}{20}$, arranged as per plans. Beam ends connected to the frames by 9x9x12-pound bracket plates. Hold stanchions, 1½ inches diameter. There will be four water-tight bulkheads, with water tight door in each. Three trimming tanks will be built in the hull, fitted with proper filling pipes, draining valves, and connected to feed pump. The bottom and sides of tanks will be covered with cement. A tank of 600 gallons capacity, of No. 6 iron, will be provided for galley use.





STEEL TWIN-SCREW VESSEL FOR THE QUARTERMASTER'S DEPARTMENT.—SEE PAGE 6.

This vessel was designed by Edward Burgess, naval architect, whose death, while in the height of his career, is announced elsewhere in this issue.

Varying Tenders for Boiler Work.

In the report of the proceedings at the annual meeting of the Manchester [England] Steam Users' Association in July last year, a copy of which has just reached us, we notice that the company calls attention to the business they are doing in procuring tenders for boilers on behalf of their members. It is interesting to note the various prices which the company have obtained for similar articles. The following cases are quoted: In one case, for a Cornish boiler, 5 feet by 15 feet, pressure 80 pounds, the lowest price was £163 and the highest £249. Difference, £86, or 34 per cent. In a second case, for a Lancashire boiler, 6 feet 6 inches by 21 feet, pressure 120 pounds, the lowest price was £301 and the highest £442. Difference, £141, or 31 per cent. In a third case, for a Lancashire boiler, 7 feet by 24 feet, pressure 100 pounds, the lowest price was £312 and the highest £500. Difference, £188, or 37 per cent. In a fourth case, for a Lancashire boiler, 7 feet 6 inches by 30 feet, pressure 150 pounds, the lowest price was £445 and the highest £660. Difference, £212 or 32 per cent. In a fifth case, for a Lancashire boiler, 7 feet 6 inches by 30 feet, pressure 140 pounds, the lowest price was £410 and the highest £515. Difference, £105, or 20 per cent. In a sixth case, for a Lancashire boiler, 7 feet 6 inches by 28 feet, pressure 100 pounds, the lowest price was £353 and the highest £455. Difference, £102, or 22 per cent. The gross difference between the highest and the lowest tenders received during the last year amounted to £3,861, equal to an average reduction on the cost of each boiler of £92, or 19 per cent.—*The Machinery Market.*

Receipts for restoring burnt steel are just now going the rounds. In our opinion, the best thing to do with a piece of burnt steel is to throw it away.

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

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☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

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NEW YORK, JULY 23, 1891.

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Machinery Interests at the Columbian Exhibition.

It is made evident by news recently received that, so far as official governmental action is concerned, we shall certainly have nothing to complain of with respect to the British section of the Columbian exhibition, for action has recently been taken, which seems well calculated to secure the fullest possible representation of British industries. The council of the Society of Arts has been constituted a royal commission to represent the government in the matter. This will result in securing the active co-operation of a number of men of the very highest ability, of world-wide reputation, and large experience in the direction of affairs connected with such exhibitions.

Among these we find the name of Mr. James Dredge, editor and proprietor of *Engineering*, who from the first has taken great interest in the exhibition. He is generally credited with having done far more than any other one man to make the British section of the Paris exhibition the success it was. With him will be associated Sir Henry Wood, as secretary of the commission, and Sir Philip Cunliffe Owen, who has been very prominently connected with most of the great exhibitions of modern times. Messrs. Dredge and Wood will shortly visit Chicago to confer with the executive committee, and get the work connected with the British section fairly under way.

There are many other indications that in England, and other countries as well, our exhibition is to be taken seriously, and that, if it is not entirely successful and satisfactory in every way, we shall have only ourselves to blame.

And this seems an appropriate time to say that there is hardly any other one thing in connection with the exhibition that will so well repay special care as in the selection and appointment of the various chiefs of the different bureaus. This applies with special force, we think, to the selection for chief of the bureau of machinery. In this matter it should be borne in mind that the Columbian Exhibition is not to be a Chicago exhibition, but an international exhibition, and for the filling of this very important place, a man should be chosen having an international, or, to say the least of it, a national reputation and acquaintance. He should be a man who not only possesses executive ability and broad knowledge of machinery, but a man whom everybody interested would at once recognize as possessed of these qualities. At the same time he should be so situated as to make it apparent that he would be unlikely to be prejudiced for or against the production of any individual, firm, section or country. No considerations of friendship or of locality should have anything to do with the selection of the man, and certainly it will not be claimed that Chicago can possibly have any better claims upon the position than any other city. While it is, of course, an important distributing center, Chicago is not pre-eminently a machinery building city, and, even if it were, the best possible man available for the position might not be found there.

The man chosen should be such that the mere mention of his name, and record of his attainments, published in American journals having foreign circulation, and in foreign mechanical and engineering journals, would be sufficient to inspire confidence in every possible exhibitor of machinery in this or any other country.

In arriving at a decision in this matter, we think those having the matter in hand cannot do better than to take council with the American Society of Mechanical Engineers. This is the organization that represents broadly the machinery interests of this country. Its standing and the value of its work are recognized the world over, wherever machinery is built or used, and the U. S. government frequently applies to it for men to carry on special work in mechanical engineering. Nothing else that we can think of besides his own well-known abilities would so surely commend the head of the machinery bureau to the confidence of machinery men everywhere as to know that his selection was approved by that society, and nothing could give greater assurance that the necessary qualifications were possessed by him. Of course we are not authorized to speak for the society, neither have we a candidate for the position under consideration; we simply want to see the machinery section of the exhibition a complete success—an international exhibit of machinery; and, to be so, we think the man at its head should in a sense be an international man, or a man with an international reputation, in whose selection the only body of men we have who are specially interested in machinery, and who have an international reputation and acquaintance, should have some voice.

New Bidders on Naval Vessels.

A short time ago we commented upon the fact that a new concern had entered the lists as a competitor for contracts on naval cruisers, the Bath Iron Works having been the lowest bidder on Cruiser No. 13, a sister ship to one now in process of construction by the Cramps.

The *Marine Journal* says that the Secretary of the Navy is reported as hesitating about awarding the contract to the Bath Iron Works, and gives some reasons why the Cramps should be given the contract at $55,000 advance upon the eastern concern's bid.

Among these reasons are that the Cramps "ought to be able to build a ship worth that much more in price, with their improved plant, and in much less time." "In awarding contracts to the lowest bidder, the government should have plenty of leeway, as lowest bidders are frequently unable to carry out the letter of the contract, owing to lack of facilities for doing the work."

This has rather a strange sound, it seems to us. If such discriminations are to be, or should be made, what is the use of appointing boards of investigation to inspect shipyards, and report upon their fitness to make bids for the construction of naval vessels?

When such an examination has been made, and it is certified by the examining board that a concern possesses the requisite facilities to enable it to satisfactorily carry out contracts; when it is asked to submit bids, under the same terms and conditions as its competitors, and its bid turns out to be lowest, it should receive the contract, and that is all there is to it.

If the Secretary of the Navy is to decide that any concern cannot build an entirely satisfactory ship, or cannot build it within the required time, or for any other reason cannot properly carry out contracts entered into with the navy department, he should reach that decision before the bidding. The mere bidding upon such a job is an expensive operation, and a concern that is encouraged to go to that expense should not be afterwards denied the contract, if fairly won according to the terms of the bidding.

It is, of course, true that the Cramps have built some very creditable vessels for the navy, but it must not be assumed that other concerns cannot build them as well, or, if it is so assumed, then they should not be invited to bid upon them.

It was a matter very frequently commented upon a few years ago that American establishments for building heavy machinery were much behind similar European establishments in the employment of means for quickly handling large work. This was true then, and to some extent is true now, but the difference in this respect is fast disappearing. In almost all new construction in this country, where heavy work is to be handled, traveling cranes, and frequently hydraulic lifts, are features of the construction. This is not only due to a better understanding of the importance of such auxiliaries by the manufacturer, but in part to the large attention that has been given to crane building in this country during the past ten or fifteen years. It is a question of demand and supply, in which it is difficult to determine which word should come first. If too little attention has heretofore been given in America to getting around quickly with heavy work, it is a weakness of the past rather than of the present.

Elsewhere in this issue we publish an address by Prof. John E. Sweet on License Laws for Engineers. While we agree with him in the main, we do not quite agree with him in what he says about boiler insurance companies. In our opinion, the best argument such companies can have in favor of insurance is that so few insured boilers explode, and we believe they are inclined to use this argument. We also believe that insurance companies favor good men for engineers, and that they favor inspection laws that do not conflict with their business in a way that they believe to be unfair.

We publish this week another article from the pen of the veteran engineer, George Escol Sellers. Mr. Sellers tells his readers that he is in his eighty-third year, but those who read his interesting articles in the AMERICAN MACHINIST several years ago will find no diminution in the force with which he handles his pen. Our readers, we are sure, will be glad to know that he is still able to give them reminiscences of times that few remember about.

A man seventy years old was recently arrested in San Francisco for the crime of counterfeiting.

Literary Notes.

CONSTRUCTION AND USE OF UNIVERSAL AND PLAIN GRINDING MACHINES.

This is another valuable addition to the series of "treatises" upon various machine tools and processes issued by the Brown & Sharpe Manufacturing Company. The mechanic who reads this book will not only know a great deal about the construction and use of the various grinding machines made by this company, but he will have a good general idea of the principles which underlie the practice of grinding as applied to machine construction at the present time.

Numerous perspective and detail engravings are given, and the text, which is abundantly supplied with marginal notes, is arranged for convenient reference, and consists simply of full and clear descriptions of the various machines, with directions for their successful use in the shop. No mechanic who does or expects ever to do grinding in machine construction, whether on a B. & S. machine or any other, can fail to be entertained and instructed in reading this treatise. The book is 6"x9", contains 147 pages, and is bound in paper covers. We are not informed as to the price, or the terms upon which it can be obtained, but they will, of course, be made known upon application to the Brown & Sharpe Manufacturing Company, Providence, R. I.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(324) J. W. W., Mt. Pleasant, Miss., asks: Have you in the past issues of the AMERICAN MACHINIST published articles giving complete directions for babbitting large bearings such as those used on self-contained engine shafts? *A.*—We have not published any articles relating to babbitting this class of bearings. All there is to it is to line up the shaft in its bearings, close up the ends of the bearings with clay, and pour in the babbitt metal. If you are a machinist the way to proceed in special cases will readily suggest itself.

(325) H. V., Baltimore, Md., writes: Please inform me if a machinist could learn to run a locomotive by studying books treating on the subject of running engines; will it enable me to pass an examination and ob-

tain a certificate, instead of commencing as a fireman? *A.*—Although the study of subjects relating to the construction and running a locomotive is essential, you cannot become an engineer without practical experience. Even if such is possible, you cannot obtain a position as an engineer without experience in firing. 2. Please give the names of a few books to study. *A.*—See our issue of February 19th, page 4.

(326) E. G. W., Gardner, Mass., asks: What do you consider the highest surface speed (with reference to friction) in feet per minute at which iron-forged shafting may be safely run in babbitt-boxes without danger of melting the babbitt, provided the best known lubricating oil is used? If you make the load a factor in the answer, designate it by *p*. *A.*—No hard and fast rules can be given for computing the surface speed; experience and due consideration of the conditions under which a shaft has to run are the best guides for determining the surface velocity. For a pressure of 400 pounds per square inch we should not allow the surface velocity to exceed one foot per second; for 250 pounds per square inch, 2½ feet per second; and for 150 pounds per square inch, 5 feet per second.

(327) Subscriber, ——, writes: Please answer the following questions if possible: Will it be practicable to pump water from a creek into a town 3½ miles distant up a grade of 150 feet, calculating on 15 to 20 pounds pressure per square inch in the city mains? What would be the pressure at the pump, and what size pump and pipe would be required at the creek? Also, would ordinary cast-iron or wrought iron pipe stand the pressure, and will it be necessary to have a pump at half way of the distance to assist the water to town? *A.*—We have not sufficient data to advise you. In fact, questions of this kind can only be answered by a competent engineer, experienced in this class of work, after a careful survey of the ground, and due considerations of all the conditions which may affect the problem. Our advice is, do not attempt to do anything of this kind without the services of a first-class engineer.

(328) J. R., Paterson, N. J., writes: I have a safety valve that leaks a little. The steam gauge registers 60 pounds, but the safety valve blows off when set at 70 pounds. Do you think the steam gauge is a little light. Please advise me what to do *A.*—Have the steam gauge tested and corrected if necessary. Put the safety valve in good working order. If then the gauge and safety valve do not agree the weight on the lever of the safety valve is not correctly set; it should be moved to agree with the pressure indicated by the gauge. 2. By lowering the eccentric pin on the rocker arm without changing the position of the eccentric, will the travel of the valve be shortened? *A.*—If the eccentric rod pin is moved away from the rock shaft, everything else remaining the same as before, the travel of the valve will be shortened. 3. Can my newsdealer obtain back numbers of the AMERICAN MACHINIST for 1889? *A.*—Yes; we keep them on hand.

(329) H. S., ——, writes: Although I have a little knowledge of algebra, I fear the following formula is somewhat too difficult for me. I shall be pleased to have you explain it; it is taken from Prof. H. W. Spangler's book on slide valve gears, page 7, equation (1).

$$x = -r \cos.(a + w),$$

x = distance the valve has moved,
r = radius of eccentricity,
a = fixed angle between crank and eccentric,
w = angle crank has moved from its central position.

How does it read? Must $(a + w)$ be multiplied by $-r$ cos.? *A.*—By referring to the book you will find that x is the distance the valve has moved from its central position, and w is the angle through which the crank has moved from its dead center. The equation reads: The distance through which the valve has moved from its central position is equal to the product of the radius into the cosine of the sum of the angles $a + w$.

(330) J. F. A., Alliance, Ohio, sends us a sketch of eight boilers in batteries of two each, with connections of the eight boilers, and asks: Is a stack 24 inches in diameter large enough for one boiler 5 feet diameter, 15 feet long, with fifty-six 3-inch tubes; 80 horse-power? *A.*—We prefer to determine the size of the chimney by the amount of coal burnt per hour. Allowing four pounds of coal per horse-power, 320 pounds will be consumed per hour in one boiler, and for this you will need a chimney 24 inches in diameter and 100 feet high. This height can be reduced by increasing the diameter. 2. How large in diameter will the stack have to be for the eight boilers of the above size? Will a stack 6 feet diameter and 100 feet high be large enough? If not, please give rule for finding the required size. *A.*—Assuming as before that it takes four pounds of coal per horse-power, the chimney will have to be large enough for carrying off the products of combustion of 2,560 pounds of coal per hour. For this you will require a chimney 5 feet diameter and 120 feet high. In our issue of April 23, 1887, you will find a table of chimney proportions for a given amount of coal burnt.

(331) S. M., Calumet, Mich, sends us an item cut from the *Youth's Companion*. It relates to a drill weighing about 2,000 pounds which was lowered into a well. In doing so the drill stuck and stopped, causing the engine to run wild, thereby reeling off a stiff cable and throwing one coil over an attendant just as the engineer shut off steam. At the same time the drill started and the mass of loosened cable ran down the well like lightning. The attendant lost his presence of mind and stood still, which apparently meant death. In order to save him the engineer started the engine so as to pay out the cable as fast as it ran into the well, which saved the attendant's life. Our correspondent writes: I do not see how it took steam to lower the drill. *A.*—There is undoubtedly an error in the description. 2. Does a weight, say 100 pounds, falling through a distance, say 200 feet, always increase its velocity as it descends? *A.*—Yes; if it has not any resistances to overcome, its velocity is found by the following formula:

$$v = \sqrt{64.4 \times h},$$

in which v is the velocity per second, and h the height in feet through which it falls. This formula, expressed in words, reads: The velocity in feet per second is equal to the square root of the product of 64.4 into the height in feet.

(332) J. P. C., ——, Canada, writes: Please let me know how to set a slide valve. *A.*—The setting of a slide valve involves three distinct operations. First, finding the dead centers of the crank; second, locating the valve at its correct distance from the center of the shaft; third, locating the eccentric. The method for finding the dead centers of the crank has been fully explained in our answer to question 323, and need not be repeated here. Before we explain the other operations it is necessary to draw attention to one precaution. All the operations involve the rotation of the crank; therefore, in order to avoid any inaccuracy which may result from the looseness in the connections, the crank should always be turned in the direction in which the shaft is to run. For the second operation turn the crank to one of its dead centers, and move the eccentric, by the eye, as near as may be to its correct position. Now set the valve to the required lead, after which turn the crank to its opposite dead center. If the eccentric is ahead of its correct position, the lead for this position will be greater than the first; if the eccentric is behind, the second lead will be less than the first, and probably negative. In either case the valve must be adjusted on the rod to divide the difference in the lead. When the lead is equal at both ends of the stroke, the valve has been correctly located. But now the lead may be either too great or too small, and to obtain the correct lead the eccentric must be moved into its correct position. To do so, set the crank on one of its dead centers, and move the eccentric on the shaft in the direction of the future rotation of the shaft until the valve has the required lead. Then turn the shaft to its opposite dead center, and see that the lead in this position is equal to the first. 2. How are the valves set in a Worthington pump? *A.*—The setting of these valves is very simple. All that is required is to set the valve on one cylinder in its central position while the piston in the opposite cylinder is midway of its stroke. 3. How can I repair a metallic spring packing? *A.*—If you are a machinist, the mode of procedure will suggest itself.

(333) H. J. C., Idaho Springs, Colo., writes: I am employed in running a Norwalk air compressor. The air is conducted 2,400 feet to the mine by a five-inch pipe, where it is used for driving drills, pumping and hoisting. In pumping and drilling it does not seem to take much air, but in hoisting a bucket containing two tons the pressure, as indicated by the gauge, falls from 100 to 75 pounds, and the speed of the compressor increases from 60 to 100 revolutions. The mine is 600 feet deep; and the time required for hoisting a bucket is 1 minute and 15 seconds. In using air instead of steam no change has been made in the engine. Should the lead be changed? Are the expansive qualities of air the same as those of steam? At times the water is low when steam is used in the engine; no changes are made, with the exception of the necessary connection to the boiler, and *vice versa*, with the air receiver. Please give what light your space will permit. *A.*—If we understand you correctly the engine for hoisting was originally designed for steam, and afterwards air was used in place of steam, without making any changes in the engine. Although engines for using compressed air differ from steam engines only in details, it is essential to pay strict attention to these details. One difficulty experienced in using air in place of steam in ordinary engines is leaky stuffing-boxes and pistons. Working against an air pressure of 100 pounds and over necessitates the use of a tight piston, the least wear causing considerable leakage. Similar difficulties are also encountered with the stuffing boxes. To overcome these difficulties provisions are often made for injecting into the cylinder, when air is used, a certain quality of lubricating liquid. Another difficulty in the use of air is that it usually contains some moisture, which, when the range of pressure is considerable, causes the moisture to freeze in the cylinder and clog the valves. This difficulty may be overcome by heating the air in passing it through externally heated pipes, or by some similar device. Enough has been said to show that, although air may be used in place of steam in ordinary engines, yet some changes are required to use the air with the best success. The decrease of pressure (to which you refer) as shown by the gauge, is, of course, due to several causes, and among these, leakage past the piston and stuffing-boxes may be prominent ones. Indicator cards taken when air and also steam is used will reveal the causes of the fall of pressure. Indicator cards will also show whether the lead should be changed. The laws of the expansion of air differ slightly from those of steam; but, for simplicity, it is frequently assumed that the laws of expansion are the same for both.

(334) G. B., Louisville, Ky., writes: I have put up a battery of three boilers, 300 nominal horse-power (100 H. P. each). I had a dispute with the engineer in charge over the grate surface. I have allowed 42 square feet of grate surface for each boiler; the engineer in charge says that 30 square feet are plenty, and after we get through with the trial he will cover up a part of surface. Give me your opinion about the boilers fired with 42 square feet, also with 30 square feet of grate surface. My space sideways was limited, and I had to go lengthways, making the furnace 6x7 feet long. He says they can't be fired. I have been an engineer on board of ocean steamers where we had furnaces 7 feet 6 inches and 8 feet long, and none of the firemen complained of having trouble with such furnaces. I have used rules as given in three or four different books, and they all give me the same result. Please publish a rule which you would use for a boiler of 100 horse-power, allowing 15 square feet of heating surface per horse-power. The boiler is a horizontal return tubular type using natural draught. *A.*—At 15 square feet of heating surface per horse-power, you have $15 \times 100 = 1{,}500$ square feet of total heating surface in one boiler; this gives $\frac{1{,}500}{42} = 35\,7$ square feet of heating surface for every square foot of grate surface, which is a very liberal allowance for natural draught; many engineers adopt a ratio of 1 to 32, and frequently this ratio is still less. Therefore, for the amount of heating surface a grate surface of 42 square feet is small enough. The terms nominal horse-power and horse-power of a boiler are very indefinite, and for designing a boiler they may lead to erroneous results. The proper course to pursue is to determine the number of pounds of coal required per indicated horse-power of the engine, which vary with the different types of engines. From this data the grate surface is found, and after the grate area has been established it is not a difficult matter to find the other proportions of the boiler. See answer to Question 246 in our issue of June 3, 1889. It is possible that your grate area, and consequently the boiler, is too large for the work it has to do. If not, the engineer will find out his mistake if he covers up a part of the grate surface. In regard to the length of grates, it may be said that the longer they are the more difficult it will be to work the fires. Although a grate seven feet long is longer than we should adopt, it can be managed by a good fireman. In many locomotives necessity compels the use of a grate ten feet long.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

George B. Grant—Gear Wheels. See p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

N. Y. City Bolt & Nut Co., Limited.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 170 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 112 Liberty St., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Universal and plain Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

Portable Cylinder Boring Machines. Pedrick & Ayer, Philadelphia, Pa.

$13.00 I. Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

One Star Hack Saw will cut steel a whole day without filing.

S. A. Smith, 23 So. Canal St., Chicago, Ill., agent for Appleton Mfg. Co.'s Emery Grinding Machinery.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

"Twenty Years With the Indicator," by Thomas Pray, Jr. 10,100 sold. Price, $2.50. Order of bookseller; take no other.

Engines and mach'y, all kinds, new and second-hand. Audubon Machine W'ks, New Haven, Conn.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N.Y. Send for des'n.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

Our catalogue of books on all subjects, including books for machinists and engineers, sent free. Norman W. Henley & Co., 150 Nassau St., N. Y.

Hawkins' Calculations for Engineers, Firemen, and Steam Users. $2 50 postpaid. Catalogue. Theo. Audel & Co., publishers, 91 Liberty Street, N. Y.

Self-adjusting Hand-Screw for Pattern and Cabinet Makers, Wood Workers, etc. Sample by mail for 50 cents. Wm. H. Denney, Lancaster, Pa.

N. Y. City Bolt & Nut Co., Limited, 33 and 35 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

Upright Drills and Iron Planers, for immediate delivery; prices reasonable. J. E. Snyder, Worcester, Mass.

Hyd. press, hyd. jacks, steam tables, accumulators, cutting and stamping dies for sheet metal, foot press, etc. S. Hartley, 245 N.J.R.R.Ave., Newark, N.J.

25″, 32″, 37″, 42″ — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

DuBois & DuBois, Patent Attys., 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo., cloth, $3. Catalogue of books on mech. subjects free. E & F. N. Spon, 12 Cortlandt St., New York.

De Lamater Screw Propeiler Wheel, made only by The Samuel L. Moore & Sons Co, Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES

The erection of an electric light plant is talked of at St. Bernard, La.

A stock company to erect a cotton-mill is being organized at Elberton, Ga.

An iron furnace is to be erected at Clinton, Tenn., by M. A. Farrell and others.

Messrs. Waring, White & Co., St. John, N. B., are building a large iron foundry.

The plant of the Donaldson Iron Company, at Emaus, Pa., is to be increased.

The Cleveland (Tenn.) Woolen Company is intending to increase its capacity.

R. J. Saywell has started an iron foundry and machine shops at Anniston, Ala.

Fair & Day will add new machinery to their machine shop, at Chattanooga, Tenn.

J. P. Anderson and others are endeavoring to establish a woolen plant at Trenton, Mo.

The Jones Foundry Company has been organized at Columbus, Ohio, with a capital of $30,000.

A. R. Steele proposes to organize a stock company to erect a cotton-mill at La Fayette, Ga.

The Crown Cotton-mills, Dalton, Ga., will double the capacity of its cotton-mill in January, 1892.

T. J. Puckalt & Sons are reported as having established a machine and gin repair shop at Opelika, Ala.

The American Bolt and Rivet Company has been incorporated at New York, with a capital of $1,040,000.

The Augusta (Ga.) Factory will, it is reported, put new machinery in its cotton mill, at a cost of $100,000.

Negotiations are pending for the removal of a 3,000 spindle cotton mill from New York to Charlotte, N. C.

The Thum Electric Safety Company has been incorporated, at Louisville, Ky., with a capital stock of $1,000,000.

It is proposed to erect a bridge over the Osage River, between Osage and Cole Counties, near Castle Rock, Col.

The Hendrick Manufacturing Company, of Carbondale, Pa., has broken ground for a new machine shop 140x40 feet.

Eastern parties are reported as to erect a plant in Middlesborough, Ky., for the manufacture of electrical devices.

A $100,000 stock company is reported as being organized for the purpose of erecting a cotton-mill at Summerville, Ga.

The Gouveneur Steel Roller Manufacturing Company will remove their works from Gouverneur to East Geneva, N. Y.

The shoddy mill of Walworth & Co., at No. 4118 Ludlow street, West Philadelphia, was recently burned; loss, $22,000.

Messrs. James, Pender & Co., who are large manufacturers of nails at St. John, N. B., are building a new nail factory.

The Pitman Manufacturing Company, of Laconia, N. H., will soon begin the erection of new buildings, at a cost of $20,000.

Eastern capitalists are investigating with a view of establishing boiler, engine and general machine shops in Greenville, Texas.

New machinery is to be added to the Standard Brick Company's plant at Cedar Crossing, Ala. A new dry kiln is also to be erected.

A representative of a Chicago (Ill.) company will investigate Fernandina's (Fla.) advantages for the establishment of car-wheel works.

It is reported that a Pittsburgh iron firm is investigating around Godger's Station, Tenn., with a view of removing its works to that locality.

The West Asheville & Sulphur Springs Railway Company, Asheville, N. C., has let contract for electric power plant to operate its street railway.

The Shenandoah Brass and Iron Works at Charlestown, W. Va., will largely increase its present equipment of machinery, and also its working force.

The Carolina Midland Railroad Company is reported as to build repair shops at Blackville, S. C. G. A. Wagener, of Charleston, S. C., can give information.

The National Electric Company has been incorporated at Alexandria, Va., with P. Mason, president, and W. J. Dante, secretary. The capital stock is $1,000,000.

The citizens of Beaumont, Tex., have guaranteed a bonus of $50,000 for the establishment of the proposed car works at that place, and building will begin at once.

The Globe File and Hardware Company has been incorporated at St. Louis, Mo., with a capital of $20,000. Stockholders, C. H. Niekamp, C. J. Becker and A. O. Rule.

It is stated that the city has accepted the proposition of J. M. Duncan, of Chattanooga, Tenn., for the establishment of a $65,000 cotton tie factory in Denison, Texas.

At a meeting of the High Point (N. C.) city council on July 6th, E. A. Snow and J. E. Cox were appointed a committee to purchase an electric light plant for the city.

A new building, to be equipped with machinery, is to be added to the plant of J. M. Robins & Co., manufacturers of special metal-working machinery at Cincinnati, Ohio.

H. C. Floyd, Gallagher & Company have organized the Edison Electric Power Company at Meridian, Miss., and are, it is stated, erecting an electric power plant.

The unused wallet shop in Athol, Mass., has been leased to Mr. Wallace, of Westfield, who will use it for the manufacture of brass goods, employing about twenty hands.

The West Michigan Car and Machine Company is the corporate name of the reorganized Muskegon Car Company, of Muskegon, Mich. The new company has a capital of $250,000.

The London Coal and Iron Company, capitalized at $150,000, has been incorporated under the laws of New Jersey, and will operate at Ducktown, Tenn., and Middlesborough, Ky.

E. M. Nettleton is president, and Frank Lyman secretary of the Covington Machine Company, lately incorporated to erect an iron foundry and machine shops at Covington, Va.

The Independent Consolidated Heating and Lighting Company has been incorporated at Chicago, Ill.; capital, $150,000. The principal object is the manufacture of gas machines.

The West End Cotton Factory is reported as to be erected at Durham, N. C., at a cost of about $100,000. The Durham Consolidated Land and Improvement Company can give information.

The Henderson Steel and Manufacturing Company, of Birmingham, Ala., are making arrangements for the completion of their second furnace and the construction of a blooming train.

A Canadian is in correspondence with the Commercial Exchange, San Antonio, Tex., regarding the removal of his works for the manufacture of ornamental iron and wire goods to that city.

The Buffalo, Rochester & Pittsburgh have lately bought $30,000 worth of new tools, mostly for car and locomotive repairs. They are going to make large additions to their repair shops in the near future.

The Enterprise Construction and Supply Company (Limited) have been incorporated at New Orleans, La., with a capital stock of $50,000, for the manufacture of electrical and other machinery and supplies.

The Southern Steel Company, of Birmingham, Ala., are considering an increase in the capital stock from $100,000 to $1,000,000. A meeting will be held at an early date to take action on the proposed increase.

There will be a meeting of the directors of the New York Locomotive Works, in Rome, N. Y., on the 24th, for the purpose of considering the proposition of increasing the capital stock from $200,000 to $400,000.

W. St. J. Jervey, C. C. Miller, W. E. Holmes and Edward Perry have incorporated the Economic Light and Power Company at Charleston, S. C., for the purpose of erecting an electric light plant. The capital stock is $100,000.

G. G. Zenor, L. C. Keever, C. J. Fulda and others have incorporated the Wilson Sugar Cane Harvester Company, Limited, at Louisville, Ky., to manufacture the Wilson sugar cane harvester machine, etc. The capital stock is $10,000.

It is announced that a party of Philadelphia capitalists, among them Albert Murphy, of the Conshohocken Tube Works, will shortly visit Duluth, Minn., and vicinity, with a view to establishing tube works in that territory.

The county commissioners of Prince George and Anne Arundel Counties propose to build a new bridge over the Patuxent River in Queen Anne's district, Upper Marlboro, Md; bridge to be of iron, 145 feet long and 12 feet wide.

It is announced that the Tripp Mfg. Company, of Boston, have decided to locate new works at South Framingham, Mass. The company have a capital of $250,000, and will erect a factory 240x60 feet, contract for which has already been let.

The Texarkana Car and Foundry Company, of Texarkana, Tex., has completed its new works, recently burned, which are on a larger scale than heretofore. This company makes a specialty of logging cars, hand trucks and saw-mill supplies.

C. F. Smith, S. N. Jones, H. D. Fitch and others have incorporated the Southern Caloric Light and Fuel Company, at Louisville, Ky., to manufacture the portable and automatic gas machine invented by J. M. Goldsmith, of Chicago, Ill., etc. The capital stock is $50,000.

O. A. Lanphear, Cincinnati, Ohio, has succeeded to the business of the Robb Closet Co., of that place and will hereafter conduct the business of furnishing sanitary dry closets on the Lanphear system. He has issued a circular illustrating and describing his system.

The Columbian Light, Heat and Power Company, of Chicago, has been incorporated, with a capital stock of $3,000,000, for the manufacture of apparatus and to furnish light, heat and power. Incorporators, Newton A. Partridge, Samuel E. Moore and John Irvine.

The Harvey Steel Car Company is extending its plant at Harvey, contracts for a new building equal in size to the works now occupied having been let. The management of the Grand Trunk system has given the company an order for eight coal cars, and these are now under way.

It is proposed by the citizens of Spokane, Wash., to raise a subsidy of $50,000, which will be used for the encouragement of manufactories to establish various plants there. Already about $20,000 has been subscribed. Among other enterprises a 1,200-barrel-flour-mill is expected to be built.

There is water-works agitation in Fairmont, Minn.; Franklin, Ky; Auburn, Me.; New Britain, Conn.; Beatrice, Neb.; Cedartown, Ga.; Lynchburg, Va; Macon, Fla.; Glenwood, Wis.; Massillon, Ohio; Scottsboro, Ala.; Norwalk, Conn.; Grand Rapids, Mich; Morris, Minn.; Quanah, Tex.; Reading, Pa.

The additional factory now being erected by the Michigan Railway Supply Company, of Detroit, will give that company a capacity of 2,000 brake beams per day. This factory is of brick, 75x300 feet in dimensions. A factory is also being built at Windsor, Ont., for the manufacture of brake beams in Canada.

The Standard Railway Gate and Manufacturing Company, of Chicago, has been incorporated. The company proposes to manufacture railway safety gates, signals, frogs, and railway supplies of all kinds. Capital stock, $300,000. The incorporators are S. M. Meek, Thomas M. Meek and Oliver R. Trowbridge.

A new electric light company has been organized at Kennebunk, Me. It is capitalized at $100,000, and the officers are: President, S. T. Fuller, of Kennebunk, and treasurer, F. M. Ross, of the same town. The towns of Kennebunk, Kennebunkport and Wells will derive their electric light, heat and power from this plant.

The steel plant at Johnson City, Tenn., is proposed to be erected upon the following plan: J. E. Kelley, of Louisville, Ky., and others are to organize a $500,000 stock company, incorporate it as the Proctor Steel Co., and erect a plant with capacity of 100 to 150 tons per day; plant to cost $400,000, and employ 800 operatives.

A representative of Armstrong Brothers, manufacturers of boilers at Springfield, Ohio, has secured an option on a large boiler plant at Chicago, Ill. If plans materialize the Springfield plant will probably be moved to Chicago. They are doing a very heavy business, valued at half a million annually, and employing over 300 hands.

The Cedartown Land Improvement Company has closed contract with Charles Roberts, of Chester, Pa., for the removal of his cotton mill to Cedartown, Ga. The main building will be 160x50 feet, with picker's-room, office, boiler and engine-house attached, making entire building about 250 feet long. The complete mill will be worth about $50,000.

The Maryland Steel Company has been incorporated by L. S. Bent, F. W. Wood, E. C. Felton and others, for the manufacture of iron and steel, the building of ships, etc. The plant will be located at Sparrows Point, Md. The capital stock is placed at $1,000,000. The above-mentioned gentlemen are prominently identified with the Pennsylvania Steel Company.

The Sessions Passenger Car Company, of Chicago, was recently incorporated, with capital stock of $500,000, to manufacture street railway cars under the patents granted to Edward C. Sessions, and also to license others to manufacture under those patents. The stockholders of the company are E. C. and H. H. Sessions, James Chasey, H. G. Bird and G. F. Brown.

The Ball & Wood Co., 15 Cortlandt st., New York, have issued a catalogue of Improved Ball Automatic Cut off Engines, both simple and compound, horizontal and vertical, condensing and non-condensing. The catalogue is finely printed and illustrated, and the descriptive matter goes quite extensively into the details of the engines, and explanations that are interesting.

The foundation of the bolt and nut factory at Curtis' Bay, Md., has been laid, and the building will be completed as early as possible. The originators of the enterprise will meet in a few days to elect officers and directors. It is expected that J. B. McDonald, president of the South Baltimore Car Works, which corporation is largely interested in the new concern, will be made president.

The Totten & Hogg Iron and Steel Foundry Company, Pittsburgh, Pa., has completed the addition to its works, an iron building 65x200 feet, and is putting in two heavy cranes which will make it possible to pour castings up to 40 or 50 tons. The company is also putting in an open-hearth steel furnace, with hydraulic cranes, and is fitting out its machine shop with new tools and rebuilding the old.

The Kingsley Foundry Company, of Lorain, Ohio, have commenced building operations upon their 20-acre purchase at Hammond, Ind. Five structures will be put up, at a cost of $100,000, work on the foundations of the main building, to be 200x85 feet, being now in progress. Besides this building there will be a boiler, engine, pattern-making room, and office buildings. All the buildings will be of brick.

The Canton Steam Pump Company, Canton, Ohio, write us: "We have at present eighty unfilled orders, and are running full force eighteen hours per day. We have recently shipped two pumps of a million and one-half gallons each, for water-works purposes in the South and West, and our export trade and foreign correspondence is steadily increasing. Since advertising in the AMERICAN MACHINIST we can trace directly a number of inquiries from France, Denmark, England and one or two other European countries, that have come from parties seeing our ad. or illustration in the AMERICAN MACHINIST. We have tried at different times various schemes calculated as foreign advertising mediums, but never had such direct results from any of them as from the AMERICAN MACHINIST."

A close corporation has been formed between the H. W. Johns Manufacturing Company and the Chalmers-Spence Company, of this city, the Asbestos Packing Company and Charles W. Trainer & Co., Boston, and the Shields & Brown Company, of Chicago. The above list comprises the five largest manufacturers of asbestos in this country. The new concern is capitalized in the sum of $1,250,000, under the name of the H. W. Johns Manufacturing Company, with offices at No. 87 Maiden lane. It is proposed, however, to open branch offices throughout the country and abroad. The officers of the new corporation are: President, Henry W. Johns; vice-president, R. H. Martin, formerly president of the Chalmers-Spence Company; treasurer, C. H. Patrick, and secretary, G. P. Erhard. The H. W. Johns Manufacturing Company is the oldest and largest asbestos producing firm in the United States, manufacturing also waterproof paints and roofing. The companies that combined with that company manufacture asbestos steam-pipe and boiler coverings. It is proposed to soon erect a large factory in Brooklyn.

The new works of the Berlin Iron Bridge Company, of East Berlin, Conn., are now completed. The company have all the machinery placed, and are now running full time, employing in all departments 400 men. The new shop in Cromwell is said to be one of the most complete and perfect bridge shops in this country. The building is made entirely of iron, no woodwork being used about the construction, except for window sash. The roof trusses are all provided with trolley cars, with which to move material back and forth about the building, and three lines of narrow-gauge tracks extend the entire length of the building—these three tracks being connected at each end of the building by a transfer table. There is a skylight on each side of the roof, extending the whole length of the building, and for a distance of ten feet down from the eaves of the building on all sides it is made entirely of glass, so that the interior of the building is thoroughly lighted. The company have purchased a large amount of new machinery, and are now prepared to furnish all kinds of structural iron work, including iron buildings, iron roofs and iron bridges, on very short notice, and, with their improved facilities, it seems as though they should be able to furnish this class of work at low cost.

Professor John E. Sweet on License Laws for Engineers.

Following is the address of Professor Sweet before the American Order of Steam Engineers at the Syracuse Convention:

Honorable Chairman, Welcome Delegates and Fellow Citizens:

We call this a free country; we call ourselves a free people; we call this a democratic government, aiming to do the greatest good to the greatest number; we call it a republic, where the majority of the voting population are supposed to decide what shall be the laws of the land, or whereas it becomes inconvenient for each voter to vote upon each law, we select, from among ourselves, such men as we suppose to have acquired more or less of the sublime art of governing the country, to make the laws for us.

But if it is a free country, we are not free to kill whomsoever we please; or at least we are not free to do so except in particular ways, and one of those ways, up to the present time, in this State at least, is by the use of steam boilers.

If you have an enemy and wish to dispose of him, and you proceed by any of the ordinary methods, in the simple form of the manly art of self defense; with weapons of peace, or weapons of war; with fire, water, or with dynamite; by poison, practice upon him with quack medicine, or in almost any way, except by a steam boiler, and law will lay its sacred hands upon you, but get him and his family, his friends and relations, or the neighborhood around a steam boiler, and blow them up, and it is an accident, a crime that receives no punishment.

If you kill a man with your fist, they will find your sore knuckles; with a stone, they will find the stone; if with concealed weapons, they will find the weapons, the place you bought them, the pistol with a missing bullet, the knife with blood, or the bludgeon with hair upon it. If you burn them up they will trace the matches, if you drown them they will trace your tracks. If you use poison or dynamite, they will find where you bought it, and the detectives will follow you to the end of the earth, and the coroner will find a motive, society is up in arms, human life is sacred, the crime must be avenged, you pay the penalty and are "electrocuted."

But go at it with a steam boiler, and if you escape the boiler there is no danger but you will escape the law. It's an accident, no motive, no one to blame, experts disagree, the boiler was perfect, it was full of water up to the third gauge, and there had been no unusual fire under it. It just exploded.

"A democratic government." "The greatest good to the greatest number." To give the poor man a job at the lowest wages, handling a torpedo that he knows nothing about to satisfy the proprietor, who is not willing to pay for a man who does, the democratic principle is set at naught, the greatest good to the owner, starvation wages to the coal heaver, and the greater number can take care of themselves.

The republican principle that the majority should rule is all right, when they will take the trouble to find out what they want and what they do not want. But they will not take the trouble, and whoever undertakes to lead them to think and reason must expect opposition, and subject himself to ridicule.

Argument will be met by argument, petition by counter-petition, and a proposed law, however just however largely in the direction of the general interest, whatever the reason, whatever right, if it is to interfere with the moneyed interest of any individual, or company, or industry, that individual, that company, and that industry will be arrayed against it. I have not taken the trouble to examine the statistics, but it will answer the purpose if we guess that a boiler explosion occurs in this country on an average of every day in the year, and serious enough if we say there is at least one person killed at every explosion; and yet, *while there was never a non-preventible boiler explosion in the history of the world*, and while every death is a *murder* or a *suicide*, indictments are seldom heard of, and the first conviction is yet to be made.

Boiler plate, which should be of the best material that the present state of the art will produce, is made to almost any degree of cheapness to meet competition. Boiler designing and building, which should be controlled by the most able skill and extended experience, is from its disagreeable nature too often left to unskilled hands, and worst of all, through the Cheap John disposition, or unfortunate poverty of proprietors, their management is left to the man who not only knows nothing of the construction or safety of the torpedo he is handling, how to manage and care for it, and worst of all, one who is entirely incapable of comprehending the enormous energy stored up in the silent envelope under his guidance.

"Life, liberty and the pursuit of happiness" is just as seriously interfered with when a man is blown into eternity by a steam boiler explosion as in any other way, and "life, liberty and the pursuit of happiness" are among the things the law attempts to secure to every man.

Human life is considered so sacred that, in case a man is arrested for any crime where the penalty is death, the law will not allow him to hazard his life by a simple pettifogger's defense. If a man tries to take his own life and fails, the law steps in and punishes him for that. If you are sick, the law says you shall not trust your life in the hands of a "quack." While the laws aim at the public good, they were not demanded or urged by the public who are benefited by them, but by the men who could see a financial advantage to themselves by so doing. The law that no man shall be allowed to swear you "to tell the truth, the whole truth, and nothing but the truth," and when you go to do it "objects," and that no man shall be allowed to browbeat a witness unless he has been admitted to the bar, was passed under the pretense and likely with truth that it was for the public good, necessary for public safety, and for the protection of human life.

The law that no man shall be allowed to practice medicine, heal the sick, glue broken bones, pull teeth, give poison or bread pills, and collect his pay for it, unless he has a legal diploma so to do, was not promulgated or urged by the public, and it may be questioned whether by the men who had only the public good at heart, but more likely by the profession, who could thereby shut out the quacks, maintain remunerative prices, and do what was perhaps even a more important thing for themselves—elevate the dignity of the profession.

Human life is often sacrificed by the falling of insecure buildings. Buildings are insecure because of improper design or defective construction. The architectural societies are moving for a law to prohibit incompetent men from practicing architecture, and the cities elect supervising architects to superintend construction, with every endeavor to prevent the erection of dangerous buildings. There is as great a reason why the architects should succeed as the lawyers and physicians.

And if human life is as sacred when in the danger of boiler explosions as in insecure buildings, quack medicine or bad law, then, as there are many more lives sacrificed by boiler explosions than in the verified cases of the other three combined, there is all the more reason why the law should reach out its protecting hand, and do what it can to relieve the public from the dangers surrounding this indispensable factor in human progress.

One of the aims of the American Order of Stationary Engineers is to urge the passage of a law requiring the owners of steam boilers to entrust their handling to the hands of such men, and such men only, as can give evidence of ability and reliability in their management, and to men who can give evidence of ability to judge of the safety of the plant they attempt to manage.

The attempt to get such a law passed, however just, is liable to meet with strenuous opposition. Not only the opposition the lawyer met in the pettifogger, and the doctor in the quack, and which the engineer will find in the careless coal heaver, not only the opposition from the men who can see an increase in price, and claim that his freedom is interfered with when he cannot get $2 worth of work out of a 75-cent man, but you who look forward to the enactment of the license law for stationary engineers, with such examinations as the United States insists upon being passed by every engineer who handles the throttle, on every steamer sailing on her waters, are liable to meet with a more formidable foe than either of those before mentioned, that is, a thoroughly organized foe, with plenty of capital and a working force at command—the boiler insurance companies. I do not say you will meet with this opposition, I only say you are liable to, and it is only giving them due credit for business shrewdness to anticipate the effort and the reasons to fear the result.

If there were no boiler explosions at all or danger from them there would be no boiler insurance companies. If there were twice as many explosions, there would be four times the demand, higher rates, and only twice the damages to pay, and the profits increased. Of course, the boiler insurance companies would much prefer that it be the uninsured boiler, or one insured by some other company, that would explode; still, the remark of an agent that "we willingly paid the loss, as we wrote a half a million dollars insurance in two weeks after the accident occurred," would indicate that fatal boiler accidents are the great stimulus to boiler insurance.

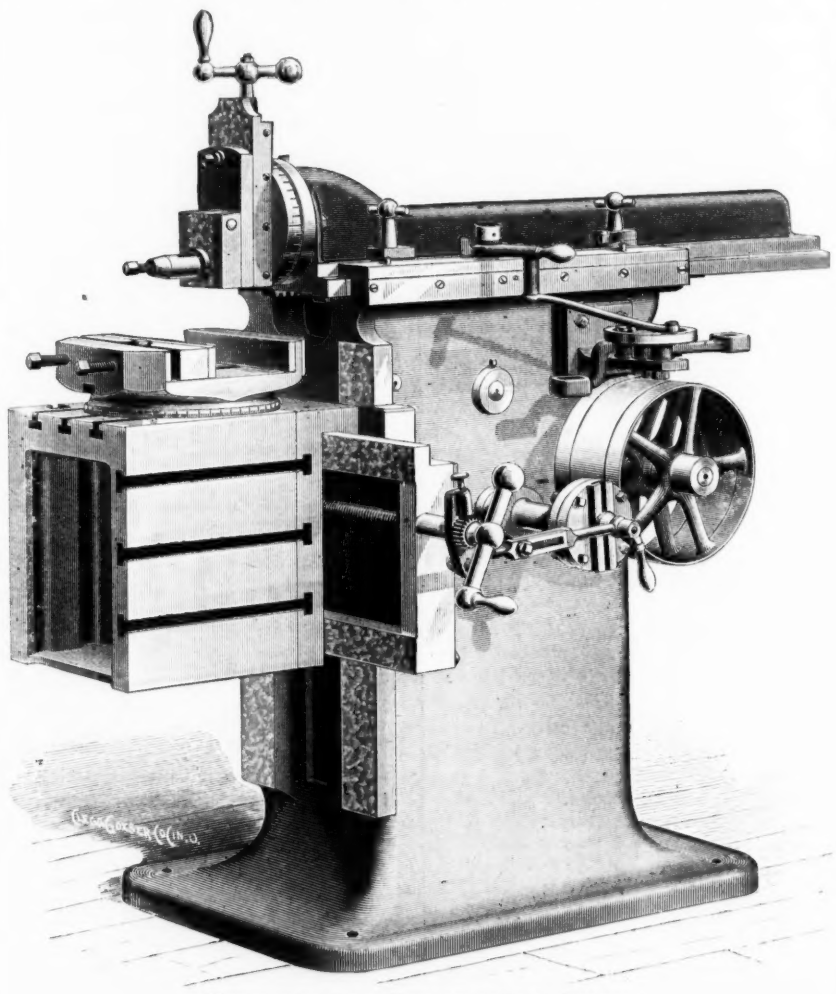
While you are looking out for your own interest and circulating your petition to present to the legislature, do not lose sight of the possibility that the boiler insurance companies, too, may be looking out for their interest, and while you are getting the names of able engineers and the endangered public to your petition, the boiler inspectors can get not only the names of all the engineers who are incapable of passing the examination, and many who can, but dread it, and all the proprietors who wish the lowest price man that will run his chances, and as many of the don't-care sort as he may choose to ask. All you can do to meet this formidable counter petition, if you meet it, is to have the facts properly set forth to the lawmakers.

There is another danger that must not be overlooked, and must be avoided, and that is a conflict between sister associations aiming at the same end. You must not expect the national association to say we favor a license law for engineers in any form so it be a good license law, until you yourselves are willing to say we are in favor of a license, whatever its particular phraseology, so long as it is a good license law. You cannot court the opposition of any one and succeed. If you cannot get it as you would like, get it the best you can and make it better when its defects are plainer and the change made easy. Do not forget, too, that this license law, whenever enacted, will strike both ways.

The license must be granted by a commission of persons delegated to grant licenses. For the law to be of any use, this commission, or the licensing board, must be of men capable of determining the ability of the applicant; for unless they are, and perform their duty, it would be but a farce. The simple certificate of membership to some organization will be no passport, and while each delegate on his return urges forward the question of licensed engineers, let him also impress upon the members of his own local society the necessity of a thorough preparation for passing the legal examination.

The board cannot meet you all in your own engine-room, however much better it would please them so to do, but they will be compelled to resort to a written or oral examination, and to meet this each must be drilled in the meetings, must study the books, must not only know the business and the principles, but he must know how to tell it. Urge upon your members the necessity of taking part in the discussions, buying books, small books—small books are better than large ones—books of such class as "Halsey on the Slide Valve," "Hemenway on the Indicator," and of which there is no doubt many on boilers, pumps, heaters, etc.

As you work for the license law, work to meet the requirements. Whatever you gain in self-improvement you will always have; whatever you do to forward a license law is in a good cause. While you will find money, self-interest, ignorance and indifference arrayed against it, march on, admitting the self-interest (for it cannot be disguised), but fight on for it, for it is in the line of human progress, the line of public safety; it upholds the sacredness of human life; it is the line of right and justice.



TWENTY-SIX-INCH DOUBLE-GEARED SHAPER.

Twenty-six-inch Double-geared Shaper.

We present with this an illustration of shaper built by John Steptoe & Co., Cincinnati.

The driving gear is of the shifting belt type, the stroke being reversed by means of dogs on the ram, which can be adjusted without stopping the machine. The machine is called double geared from the fact that there are two racks on the ram, which are placed one each side of the center, the teeth of one of these being just opposite the spaces in the other, the object of this being to secure steady and smooth movement with the least possible back lash. The driving pinion makes 42 revolutions to one of the rack pinions, and the main driving gear is placed outside of the frame for the purpose of securing room for the large gear necessary to secure the high belt speed used, this high belt speed enabling the belts to be shifted easily and giving them great power.

The belts are shifted separately, and when shifted are locked in place by the cam plate until it is again moved. The screw and gears for raising the table are inside the frame, where they are protected from dirt and injury. Under the ram is an opening which admits of shafts up to 3¼" diameter being passed through for key-seating. The tool-box can be removed from the end of the ram, and a tool inserted in its place, suitable for key-seating a pulley or for similar work, the feed being obtained by moving the table upwards. The box table can be removed when desired, and work bolted directly to the face of the saddle to which it is attached.

The stroke is 26"; traverse of table, 26"; vertical adjustment of table, 20"; traverse of tool slide on ram, 9". The countershaft is arranged for two speeds. The machine weighs 2,600 pounds. It may be seen at the store of Messrs. Cooke & Co., 163-5 Washington street, New York City.

There is no doubt that a growing number of stationary engineers are coming to use the steam engine indicator; a good many of them are learning to read the diagram in all its essential points. But there are too many who conclude, when they learn to set their valves about right as to lead, that that is all there is which they can determine by its use. So they rest about there. This is not right. The indicator and the indicator diagram are well known and fully explained, and their complete study is as likely to prove profitable to a stationary engineer as the study of any subject connected with his business.

There were 2,159 boiler explosions during the twelve years between January 1, 1879, and January 1, 1891. These explosions resulted in the death of 3,123 persons, and in more or less serious injury to 4,352 others. We see, therefore, that on an average 1.45 persons are killed per explosion, and 2.02 others are injured; that is, 3.47 persons are disabled, on an average, by every boiler explosion.—*The Locomotive.*

Edward Burgess, who recently died in Boston, was one of the best known designers of yachts in the world. He was born in 1848, graduated at Harvard, and finally taking up the designing of sailing vessels, achieved a world-wide reputation.

Machinists' Supplies and Iron.

NEW YORK, July 18, 1891.

Iron—American Pig—The market is generally dull, and prices to some extent nominal.

We quote: No. 1 Foundry, Standard Northern brands, $16.50 to $18; No. 2 is selling at $16 to $17, and Gray Forge at $13.90 to $14.50. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; and $15.75 to $16 for No. 2; and $14 to $14.50 for No. 3.

Scotch Pig—We quote at $24.50 for Coltness; $22 for Dalmellington; and $20.50 for Eglington.

Copper—Nominally, Lake Copper is held at 13c., but there are rumors of sales at 12½c.; Arizona Ingot is quoted at 12½c. to 13c., Casting copper, 12¼c. to 12½c.

Lead—There has been no business to speak of, and nominal prices are 4½c. for prompt delivery.

Spelter—The market is dull, and prices nominal at 5.08c. to 5.10c.

Tin—The market is dull, and there is very little interest manifested by speculators or dealers. Values for spot are at 20.50c. to 20.75c.

Antimony—The local market is dull.

We quote Hallett's at 11¾c. to 12c.; Cookson's, 13c. to 13½c.; and 12½c. for L. X.

Lard Oil—Prices are maintained at 52c. to 53c. for City; Western at 51c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

All round young machinist; aged 21 years, desires change; will go anywhere. Fulton, AM. MACH.

Wanted—Two first-class die sinkers, steady employment. Ottumwa Iron Works, Ottumwa, Iowa.

Agents wanted in every shop to introduce micrometers, etc. Address E. G. Smith, Columbia, Pa.

A young mechanical draftsman, with first-class ref's, desires a position. Permanent. AM. MACH.

Wanted—To take interest in foundry, by a practical iron moulder. Address H., AM. MACHINIST.

Skillful mech. draftsman desires engagement; thorough in compound engs. and general machine designing; best of refs. BOX 22, AM. MACHINIST.

Wanted—Re-engagement as foreman; a lifetime specialty in taps, dies, etc.; had considerable experience managing men. Address BOX 17, AM. MACH.

A mechanical engineer (mem. A. S. M. E.) with office in New York, desires to represent the manufacturer of some specialty. BOX 21, AM. MACHINIST.

Sit. wanted as foreman; all-round exp.; blacksmith line, hammer & drop; also presses, die-hardening, &c.; good ref. J. L. R., Hartford, Conn.

Wanted—Three pattern makers; those experienced on pump or engine work preferred. Deane Steam Pump Company, Holyoke, Mass.

A good designer and draftsman, with outside experience and excellent mechanical judgment, seeks change of position; ref's. BOX 20, AM. MACHINIST.

Wanted—Experienced draftsman on presses and special machinery; steady employment for competent man. A. B. C., care AM. MACHINIST.

Wanted—A position as engineer or machinist; twenty years' experience; thoroughly understands the construction and erection of Corliss engines. Address Machinist, 274 N. Main st., Providence, R. I.

Young man of ability, with 15 years' experience as mechanic, draftsman and superintendent, wishes a position of responsibility in two or three months. BOX 23, AM. MACHINIST.

Position desired as superintendent or foreman by a live, driving, experienced man; a thorough draftsman, and well posted all the way through. Address BOX 18, AM. MACHINIST.

Wanted at once, an energetic young man to give instruction to students in a college shop; he must be a first-class general machinist, with some knowledge of blacksmithing and pattern making. Address fully, but briefly, F. A. Weihe, Newark, Del.

Wanted—Two mechanical draftsmen, first-class men with technical education, acquainted with our class of work; to the right men we can give permanent situation and reasonable wages. Fitchburg Machine Works, Fitchburg, Mass.

Wanted—To correspond with parties in need of a practical millwright and erecting engineer, or will take charge of a good steam plant; well up in steam machinery; Va. or Tenn. preferred; age 30, married; best refs. Hustler, AMERICAN MACHINIST.

Wanted—At Pittsburgh Locomotive Works, Pittsburgh, Pa., a competent foundryman to take charge of iron and brass foundries; must be active, entirely temperate, and thoroughly understand locomotive work; state salary expected, and give references.

Mech. engineer (young) with good exp. in supervising mech. work, designing and drafting—not a tech. graduate, but a student for improvement after business hours—wants to change position; object, opportunity for advancement; refs. Box 19, AM. M.

Wanted—A thoroughly competent man for superintendent of a manufacturing concern (in the West) doing a general foundry and machine business, and employing 100 men; must be a good foundryman, and well up in construction of machinery, with ability to manage men; a good position to right man. Address D. K., AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

Boiler for sale; one 70 horse-power horizontal tubular boiler in good order; will be sold cheap. Ann Arbor T.-H. Electric Co., Ann Arbor, Mich.

For Sale—Three 3-ton jib cranes. 20 ft. height of mast, swing in space of 35 ft. Can be seen in position until July 15th at works of The J. Morton Poole Co., Wilmington, Del.

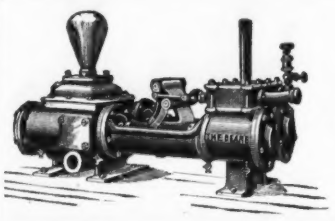
Wanted—Agents for Mechanics' Reference Book of Practical Rules and Tables. All mechanics should send 15 cents for this book. Address Summit Pub. Co., Akron, O., Box 40.

Machine shop and boiler shop, with all necessary tools, for sale or rent; located at West Point, Pa., twenty-four miles from Philadelphia. For particulars address D. C. Wismer, Quakertown, Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

FOR SALE.
MACHINE SHOP

Established eight years on D., L. & W. R. R.; 12,000 inhabitants within radius of 3 miles. Some good specialties (not patented). Tools nearly new, all in first-class order; land enough to suit purchaser; shop enough to run 25 men, with good contracts in sight. Address BOX 16, AM. MACHINIST.



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OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO'S
Pittsburgh, Pa.
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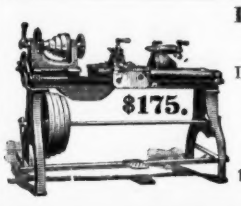
New York, N. Y.
TOOL & DIE STEEL
of Uniform Quality and Great Strength.



Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

FINE TAPS, DIES, REAMERS, ETC.,
LIGHTNING AND GREEN RIVER SCREW PLATES.

Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., Greenfield, Mass. New York Agency, 126 Liberty St.

IT WILL PAY
you to investigate the merits of
THE HACKNEY POWER HAMMER
Endorsed by leading manufacturers
throughout the country.
Catalogues and all information cheerfully furnished by
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For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
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Courses in Civil, Mechanical, Electrical and Mining Engineering. Extensive and well equipped laboratories. A two years' course in mining. Catalogues sent on application.

The Bradley Cushioned Hammers

Never Questioned.

The superiority of the Bradley Hammers has never been questioned. Some think the price is a little high, but no other manufacturer furnishes as much. Anvil block made separate, not cast in one piece with the main frame. Wide eccentric and strap, not a little crank pin. Slip sleeve for instantly changing length of stroke. Rubber cushions to absorb the concussion. Helve, Upright and Beaudry styles. Send for catalogue.
BRADLEY & CO., SYRACUSE, N. Y. Branches at 14 Warren St., N. Y., and 96 & 98 Sudbury St., Boston.

FITCHBURG MACHINE WORKS,
Manufacturers of
Metal-Working Machinery.
OFFICE AND WORKS
NOS. 13 to 21 MAIN STREET,
FITCHBURG, MASS.
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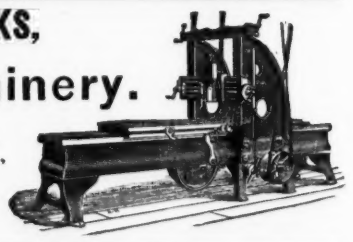

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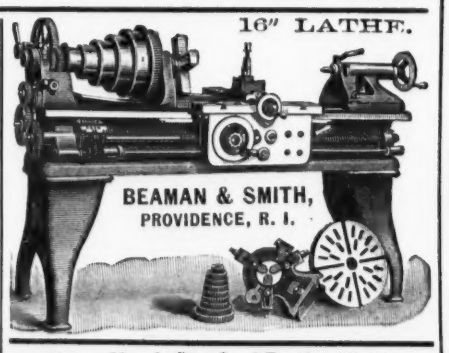
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

16" LATHE.



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—BY—
W. E. HALL, M. E.
12mo, Cloth, $1.00.
JNO. WILEY & SONS,
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R. MUSHET'S SPECIAL and TITANIC STEELS.
How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.
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PATENT END GRADUATION
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
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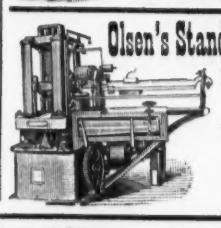

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Hydraulic Machinery a Specialty.
TINIUS OLSEN & CO.,
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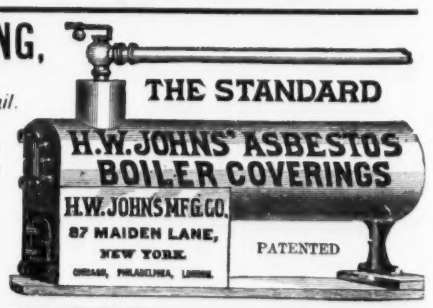
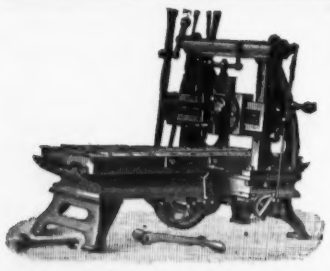
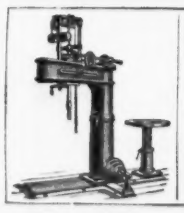
ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.





SMALL POWER OR HAND PLANER.
FOR ANY SMALL WORK.
Weight of Platen 100 lbs.
A. J. WILKINSON & CO.,
184 Washington St., BOSTON, MASS.
SEND FOR CIRCULAR.



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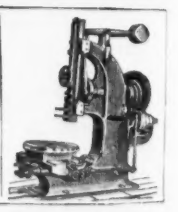

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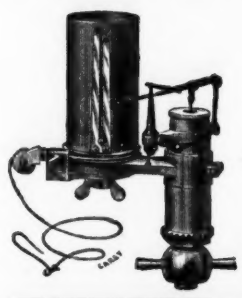
FILES AND RASPS
FOR EVERY VARIETY OF WORK.

THOMPSON IMPROVED INDICATOR
MANUFACTURED SOLELY BY
American Steam Gauge Co.
5,000 IN USE.



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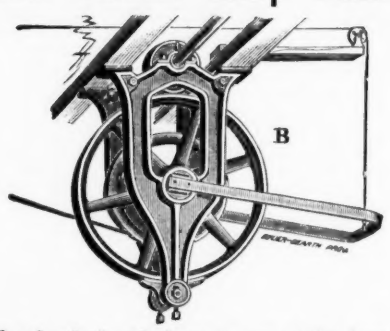

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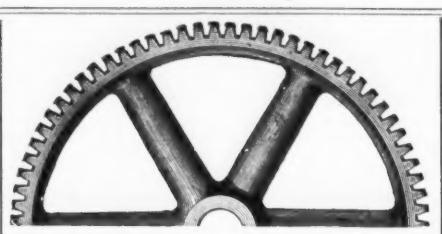

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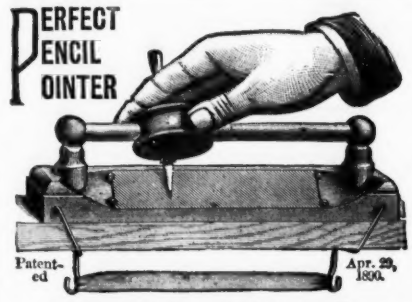

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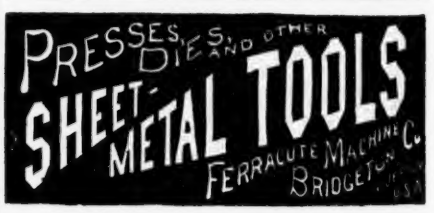

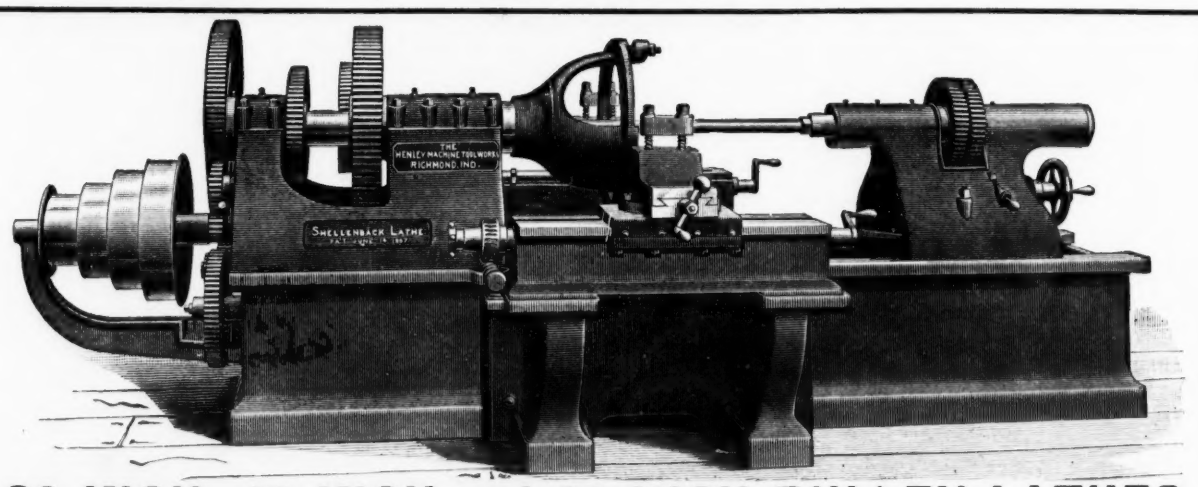

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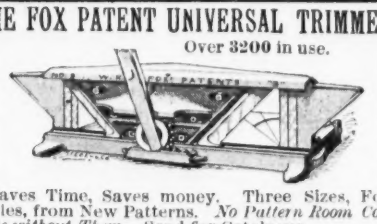

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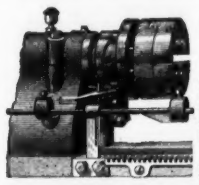
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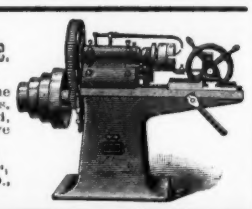

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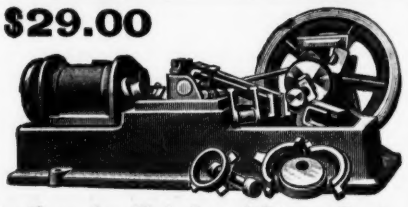
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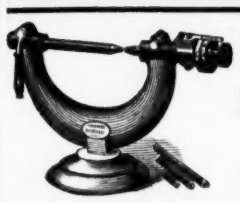
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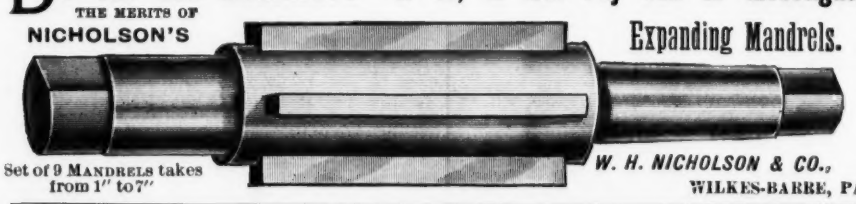
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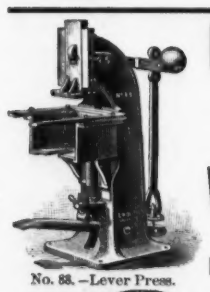
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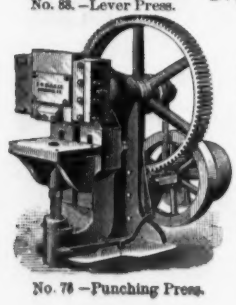
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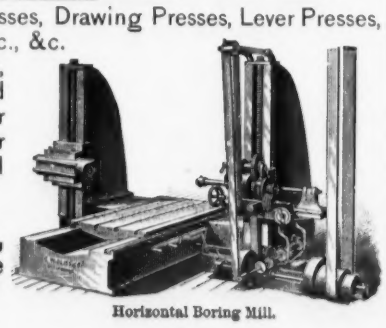
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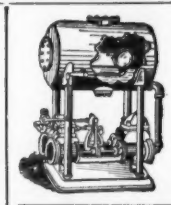
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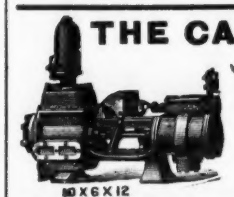
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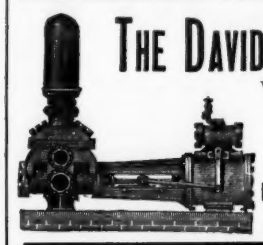
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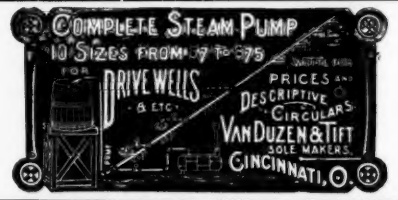

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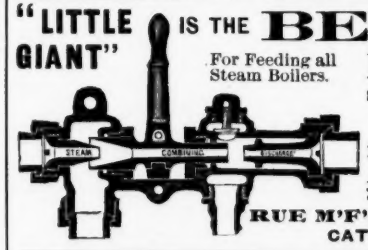
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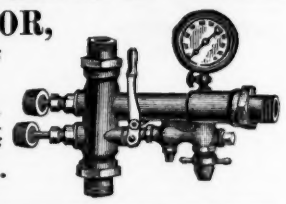
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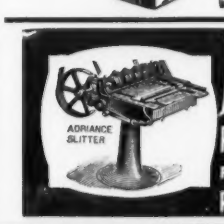

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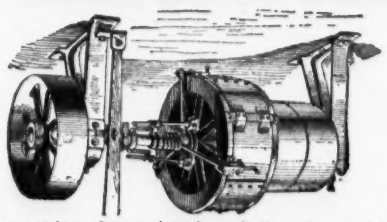
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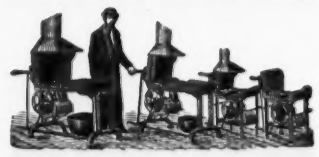
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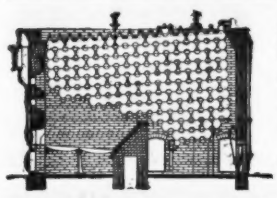

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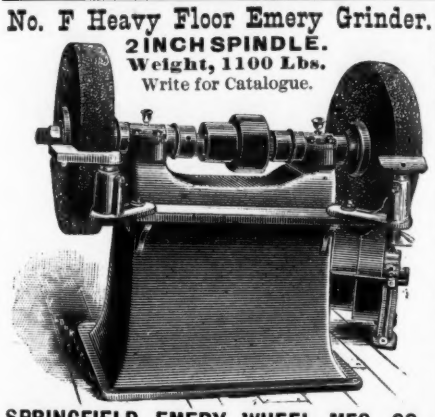

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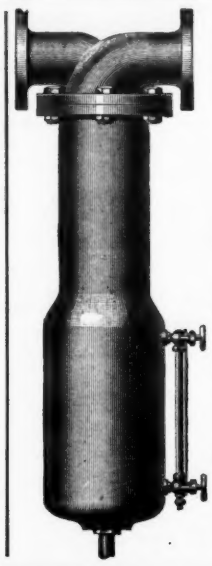

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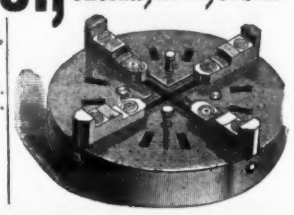

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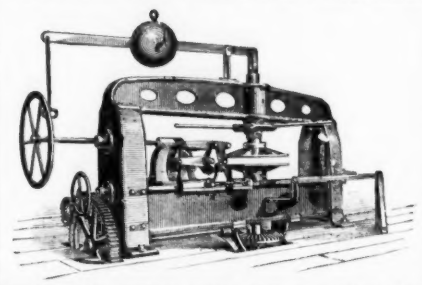

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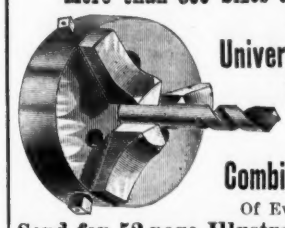

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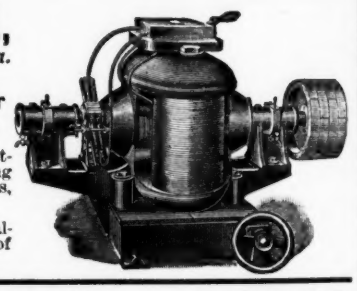

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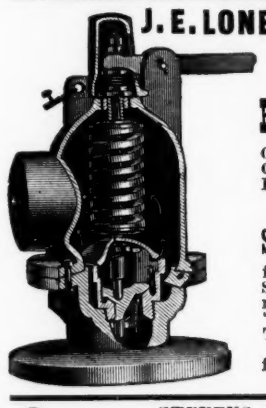

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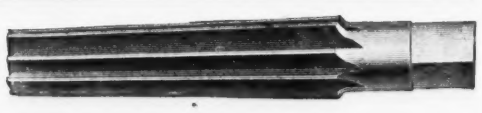

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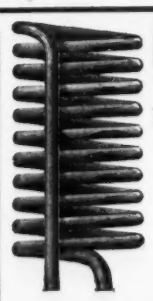

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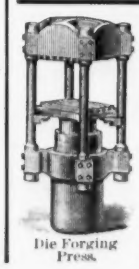

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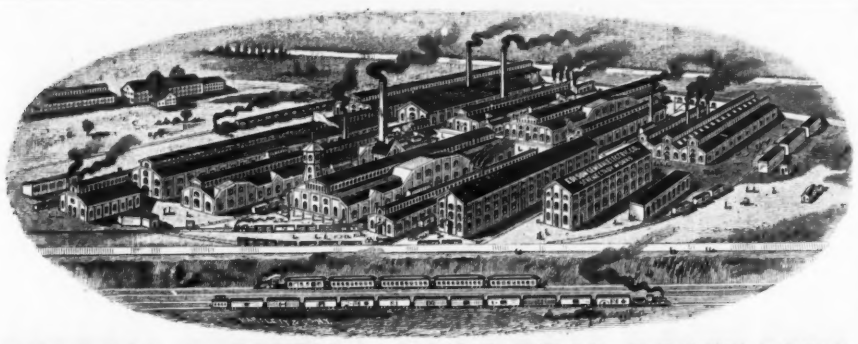

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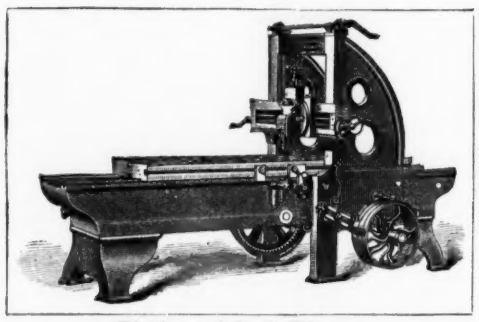

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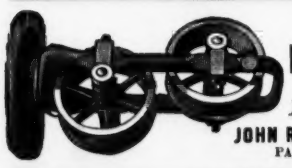

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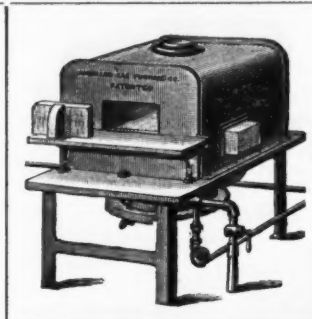

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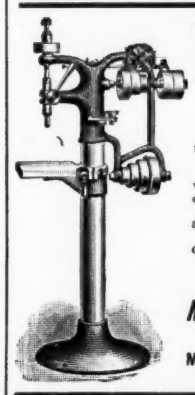

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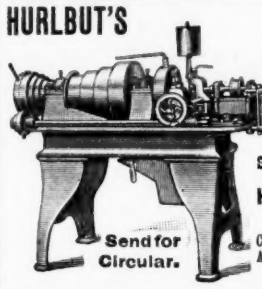

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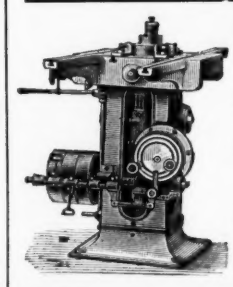

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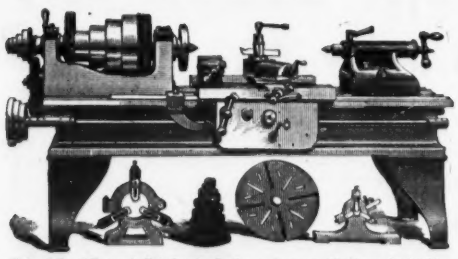

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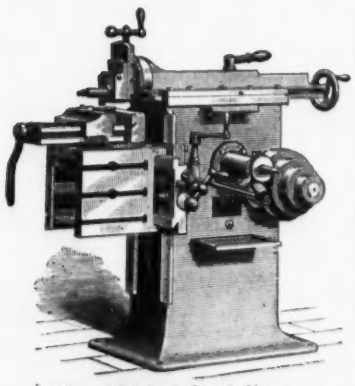

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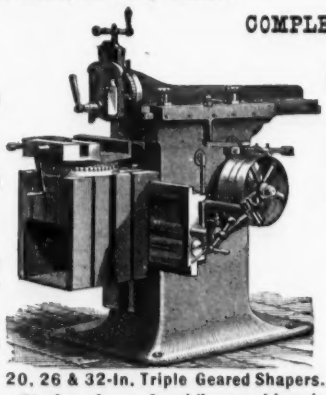

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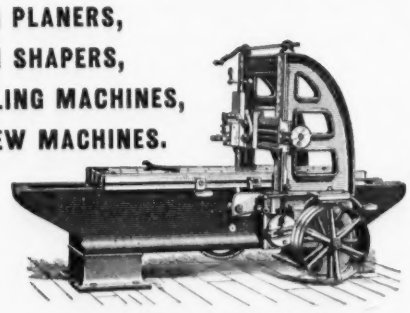

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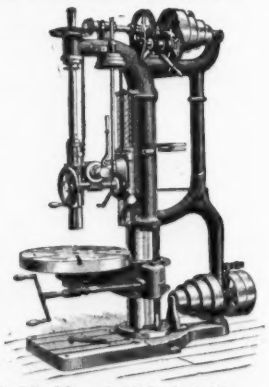

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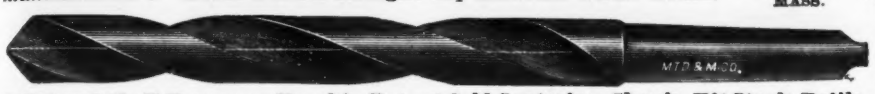

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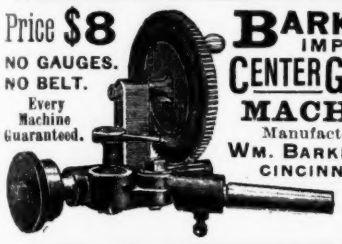

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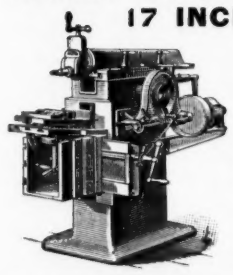

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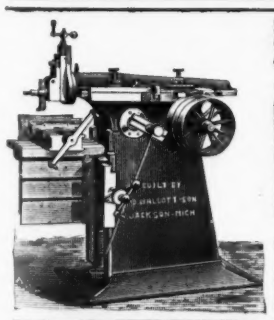

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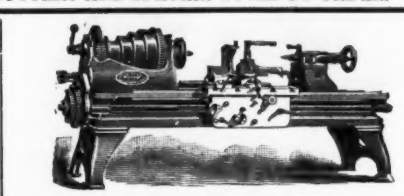

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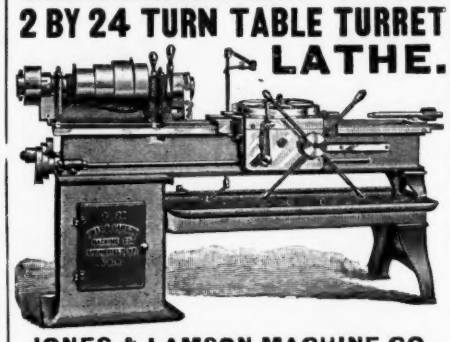

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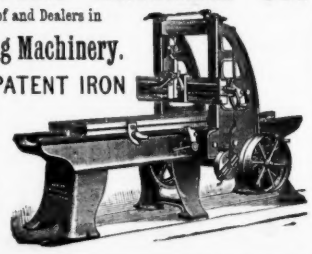

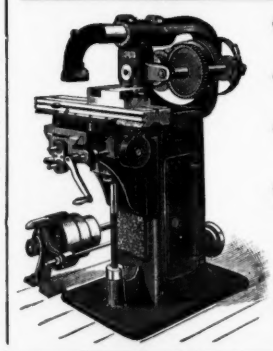

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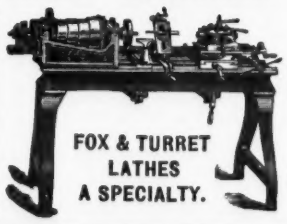

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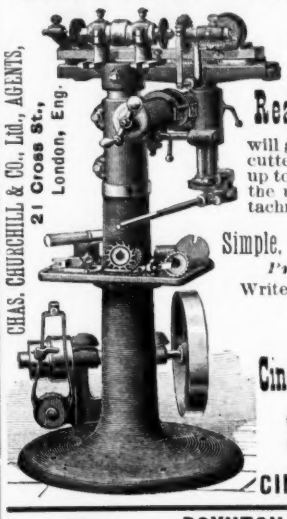

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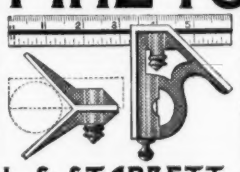

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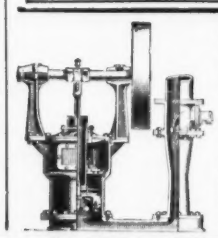

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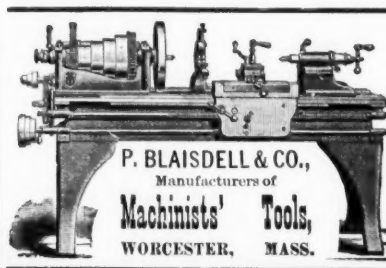

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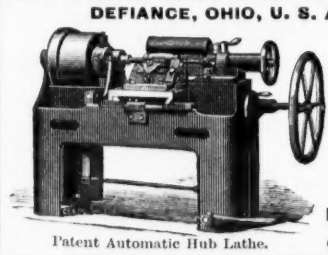

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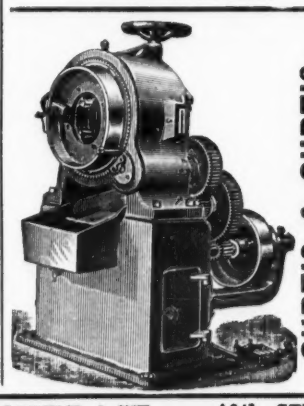

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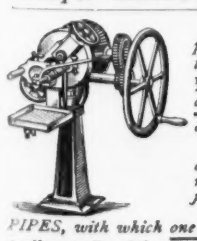

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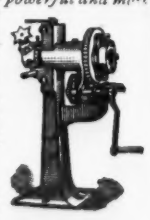

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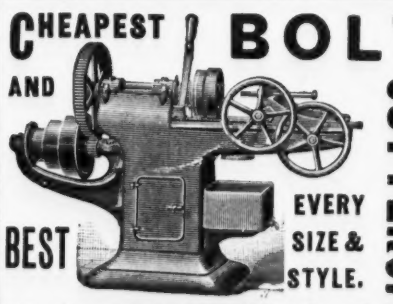

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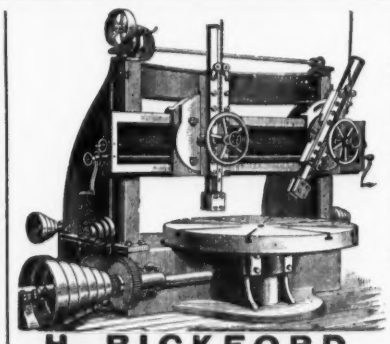

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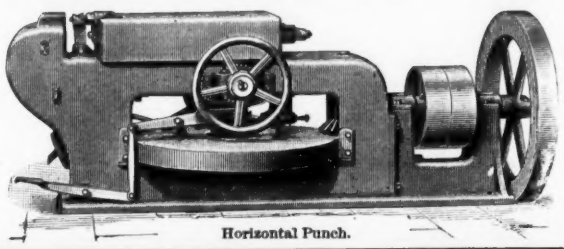
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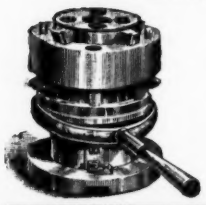
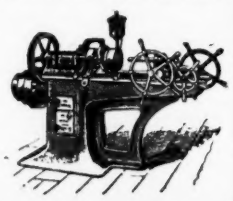

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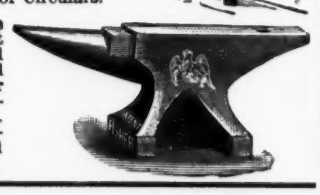

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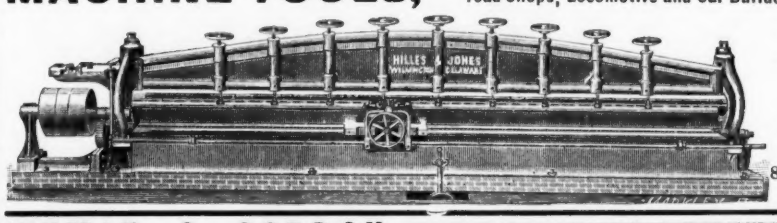
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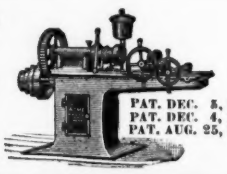
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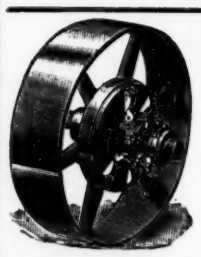
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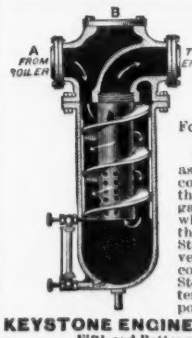

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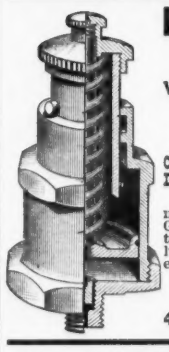
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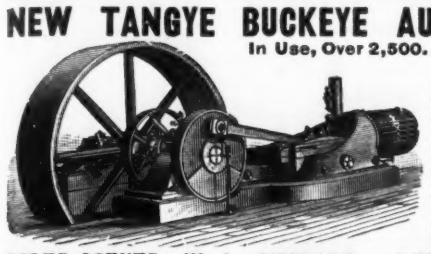

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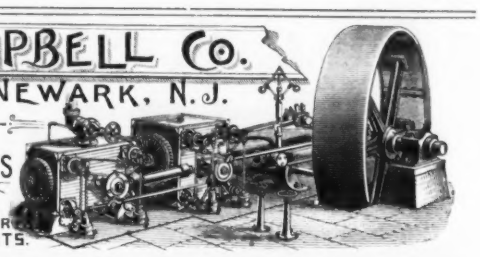

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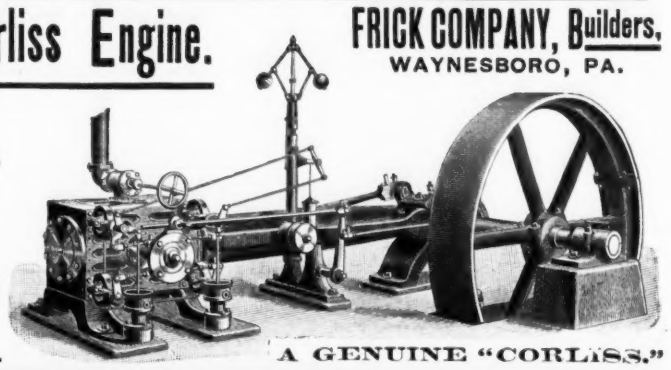

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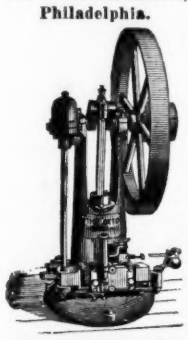

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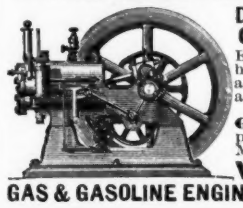

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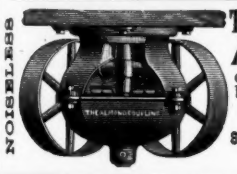

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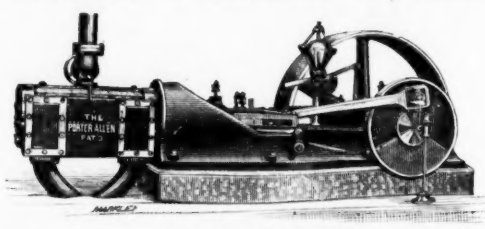

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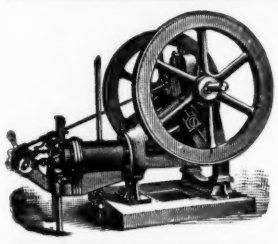

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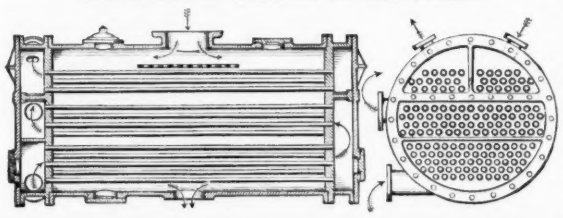

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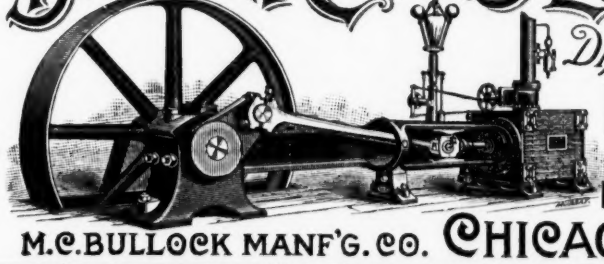

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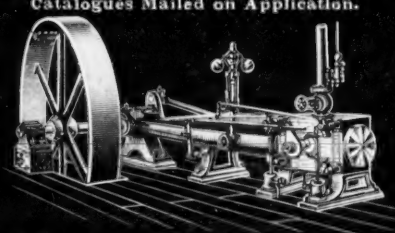

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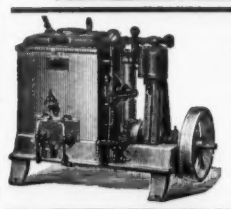

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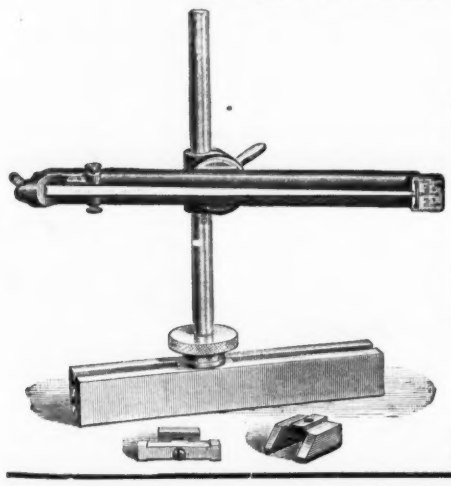

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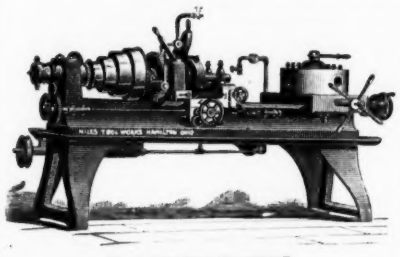

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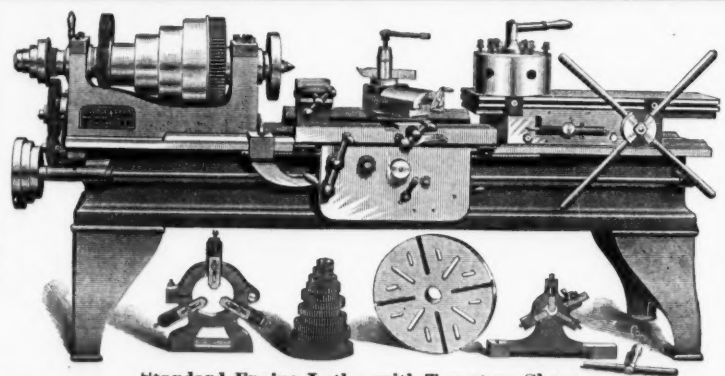

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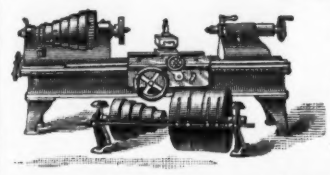

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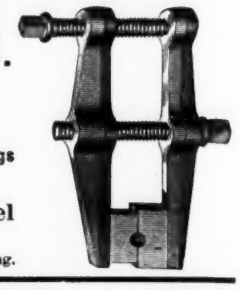

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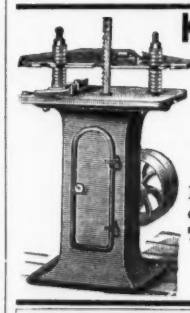

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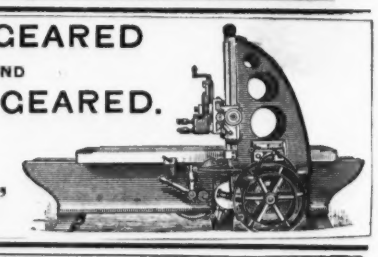

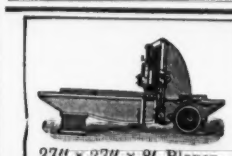

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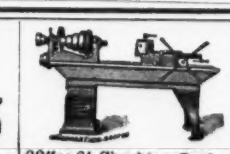

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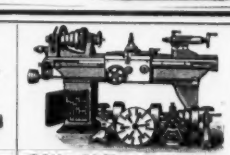

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